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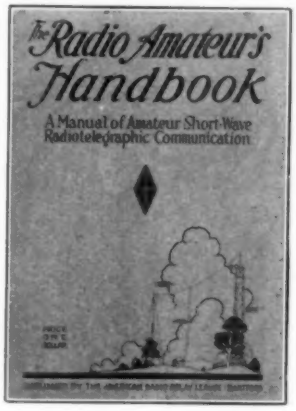
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American Radio Relay League, Hartford, Conn., U.S.A.

QST

The Official Organ of the A·R·R·L

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It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a Board of Directors, elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its board.

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EDITORIALS

IN LATE December the Federal Radio Commission presented an expectant radio world with a Christmas package of large proportions in the form of the long-awaited decision respecting the so-called continental frequencies between 1500 and 6000 kc. Throughout 1928 a prodigious amount of study had been given these frequencies in Washington. Numerous hearings were held, thousands of applications were received and considered, several conferences were held with the other nations of North America, technical experts labored and reported at the request of the Commission, unreckonable testimony was taken. It has been a problem of great magnitude, next in importance only to the determination of policies with respect to broadcasting and the higher frequencies above 6000 kc. The Commission's decisions are of what is known as far-reaching importance, concerning many phases of which it is not our business to comment now. We amateurs have had a vital concern in the question, however, because included in this frequency range are the two amateur bands from 1715 to 2000 kc. and from 3500 to 4000 kc. In the international treaty signed at Washington in 1927 these two bands are internationally marked as shared between amateurs and the fixed and mobile services. This means that any government may make such sub-divisions of these bands as it wishes amongst these three services. In our country, of course, our government's representatives to the International Conference were willing to agree that these bands should be assigned to amateurs, except for the extent to which the last-named band is shared by Naval aircraft at sea by authority of the President.

Until the regulations in this frequency range were definitely announced by the Commission, however, the outcome had to be regarded as uncertain and there was much jockeying for position throughout the year on the part of various radio interests, including many people who could not understand why any such appreciable extent of radio territory was to be given to amateurs. Representatives of our A.R.R.L. were in attendance at Washington throughout last year when these questions were being considered, for we all know that that 3500- to 4000-kc. band is our life's blood now, the only place in the spectrum where we really have room enough to turn around in. There is really a frightful amount of radio activity going on in Washington all of the time, and we wish that the members of the League could know how much of the unseen effort at Headquarters is expended in the constant effort to look after our affairs there. Much of it never gets reported in *QST* to the general membership, as generally it is not "news" unless there is some actual change in regulations.

In the present case, however, it is with real pleasure that we report that the Commission's announcements confirm the assignment to American amateurs of these two bands. Thus one long-awaited and important hurdle in our progress towards readjustment under the 1927 convention is safely topped.

We breathe more easily and look around us. We find the government radio department talking about us in their annual reports. The Federal Radio Commission's annual report to the Congress had the following to say about us:

"There are 16,926 amateur stations licensed. The radio division of the Department of Commerce has generously coöperated with the commission in the handling of amateur-station licenses.

"The international convention authorized each Government to assign certain frequency bands to amateur use. The Commission has followed the policy of authorizing amateur use of all such bands. The Commission has felt that the amateur has sufficiently demonstrated his usefulness, both in furthering the progress of the science of radio and in furnishing service in times of emergency, to justify a liberal policy with regard to his operation."

Amateur radio has grown in the past government fiscal year. The figure 16,926 represents an increase of 6.3 percent in the number of licensed amateur stations. Mr. Terrell, the Chief of the Radio Division of the Department of Commerce, in his annual report to the Secretary of Commerce, comments as follows about us in the portion of his report relating to amateurs:

"The amateur radio operators have received international recognition. At the International Radiotelegraph Conference, held in Washington October 4 to November 25, 1927, agreement was reached whereby the status of the amateur radio operator

was defined; his service as an experimenter and his value in promoting international good will recognized, and his continued activity assured by the allocation to him of certain specified wave lengths. This recognition was accomplished through the efforts of the delegations of Canada, Italy, Australia, New Zealand, and the United States. The new international treaty provides a new system of amateur calls to indicate nationality. The provisions of the new treaty become effective January 1, 1929.

"In September, 1927, at the request of the radio division, the American Radio Relay League made a survey to determine to what extent amateurs and former amateur radio operators are occupied in the radio industry. While it was impossible to get reports from all organizations employing men coming under this heading, the list furnished gives a fair idea of the extent to which the radio art and industry has recognized the value of amateur training and experience. Of those engaged in executive positions in the radio industry, the list shows 45 presidents, 16 vice presidents, 5 general managers, 69 managers, 37 owners, 324 engineers, 19 announcers, and 11 directors. This does not include those employed as operators."

Speaking of the International Conference he again mentions that:

"The conference gave definite recognition to the amateur in international radio communication. The allocation to amateur service of four exclusive bands and two nonexclusive bands was secured through the efforts of the American delegation, with the support of the delegates from Canada, Australia, Italy, and New Zealand. The result is to give the amateurs much greater assurance of making contact with one another internationally."

We write in the early days of January. January 1st, another tremendous hurdle, has been safely crossed, and somewhat to the surprise of some of us we seem to be still alive and kicking. The air seems very much the same as it was before; in fact, too much so. There are no changes in amateur regulations except in the width of our bands, but every amateur knows that these widths were changed effective the first of the year. We cannot feel that there is excusable reason for an amateur operating outside the new frequency bands—our preparation for success within these limitations has been thorough and the means are at hand. All of us must realize, whether we get any great pleasure in the thought or not, that the high-frequency spectrum is now a highly-organized area nicely laid out in neat skinny strips, and he who gets on the wrong side of his fence is very liable to be jerked up without warning for trespass. We can still have plenty of fun—let's play the game.

K. B. W.

Official Frequency Stations

THE Official Frequency Station system furnishes a service cooperative with but differing from that of the Standard Frequency Stations, W9XL, which is also operated in accordance with plans made with the O.F.S.Committee.

The chief duties of the O.F.S. are to indicate the frequency of each transmission at its termination, to check the frequency of other transmissions when requested and to aid in the general work of keeping all amateurs within their assigned bands. The announcement of frequency at the end of each transmission will be in kilocycles and consist of four or five numerals without any punctuation whatever.

An accuracy of at least 0.5% is required of all O.F.S. and it is expected that they will check their frequency meters at least once every two months against a suitable standard or Standard Frequency transmissions from W9XL.

See page 68 of the November issue of *QST*.

The present list is as follows:

W6XAO-W6ZV, VE3FC, OZ2AC, W6AM, W1CK, W1AWW, W8EQ, W4XE, W5ZAV, W9EGU, W6ZH, W2MU, W4BY, W5SP, W7GQ, W2DS, W1BZQ, W6BGM-W6CVO, W9IG, W1ZL-W1AVW, W2CLA, W8GZ, W8ZG, W9BGK, EG2NM, VE9AL, W8APZ, W5OX, W1AAC, W8BZT, VE3CO, EG2OD, W6CAE, W9AXQ, W9CPM, W5EW, W1AXA, W9BGH, EG2SZ, W6BB, W8DAJ, W9AUG, VE2BE, W2BRS, VE4BT, OA5BG, W4LK, EGGI5NJ, W1CCW, W8BAU, W9UZ, W2EF, W6AKW, W6CDY-W6CRX W6AYC, W6BRO, W6WN, W6BMW, W6CMQ, W7AAT, W9AHQ, W9EFO, W6BAJ, EG5YK, W6BZU, W1BD, W5NW, OA7CW, W6EC-W6XE, W6QX, OA5LF, W6QL, W5BG, W2DC, W9BVC and W2UV.

—*H. P. W.*

The Requirements of Transmitter Keying

A Review of Principles and Methods Together With Suggestions Concerning Some Modifications for 1929 Operation

By Ross A. Hull*

SHOULD you run through the vast array of text-books and manuals treating radio principles and practice and the technical periodicals devoted to the same subjects you would find a curious disregard of considerations involved in the keying of transmitters. Through hundreds of pages the tubes are arranged in a variety of circuits, adjusted to fulfill the requirements of various equations and so caused to provide the most stable frequencies at certain efficiencies. Then, when the tubes are about to become useful for radio communication the books usually lapse into a chapter on "Antenna and Radiation" or perhaps just an index. Keying probably has received wider treatment in *QST* and *The Radio Amateur's Handbook* than in all other radio publications together.

Of course, there is an explanation for this condition. Most technical manuals are written for the professional radio engineer in whose field keying is a problem only in special instances. The commercial transmitters of the present day are each provided with a frequency channel all to themselves. Usually they are located where interference with broadcast reception is not a consideration. Then, they are almost invariably crystal-controlled. Under these conditions the keying problem is just one of causing the output of the transmitter to be interrupted at periods demanded by the speed of keying.

In amateur work, however, where the transmitting antenna and the neighbors' broadcast receiving antennas make criss-cross patterns over the back fence; where the self-excited transmitter is of necessity the back-bone of most stations and where the amateur signals of all the world are boxed up in narrow frequency bands, the importance of the problem is of a very different order. And yet it is surprising how keying is neglected by amateurs except in cases where interference with broadcast listeners makes some careful consideration of it a necessity. Transmitters may be built in accordance with what is now considered good practice, they may be adjusted mechanically and electrically to give the most stable frequency and the cleanest note but at this stage there is usually an abrupt break in the sequence of affairs. "That sure is a nifty note", is the exclamation. "Let's have that key—we'll see if we can raise someone". And the key is hitched in the center-tap, or the gridleak lead, where it usually remains to cause thumps or chirps until such time as the neighbors demand some modification. We know all that—we've done it ourselves. But times have changed. The broadcast listeners must still be considered, but now, for purely selfish reasons, the amateur is obliged to pay as much attention to the keying as any other feature of the transmitter. Investigation has shown definitely that even the very best "1929 type" carrier can be hacked into an "early 1928 type" signal if keying is performed improperly.

In previous articles we have shown that no particular difficulties are involved in building and adjusting a transmitter to give that standard of frequency stability and note character which have been styled a "1929 type" signal. So far, however, we have not treated the manner in which such a signal can be chopped into dots and dashes effectively. We are to see that the attainment of a high quality signal is one problem while the keying of it without destroying its quality is another of perhaps equal importance. We trust that we will be pardoned, therefore, if we wander off into a thicket of preamble and explanation in our attempt to tell the entire story.

One possible specification for the ideal keying system for the amateur transmitter could be outlined in this manner:

1. The arrangement should be sufficiently simple in construction and operation to be within the means and abilities of any amateur.

2. The keying should be positive at all times.

3. The output frequency should remain constant.

4. High amplitude transients or surges which give rise to "key thumps" should not result from the opening or closing of the key.

5. Rather should the wave train of each dot and dash be tapered in amplitude at the beginning and end in order to minimize shock

*Associate Technical Editor, *QST*. In Charge A.R.R.L. Technical Development Program.

excitation of neighboring receiving antennas.

6. No abnormal stress on any apparatus of the transmitter should result from the keying.

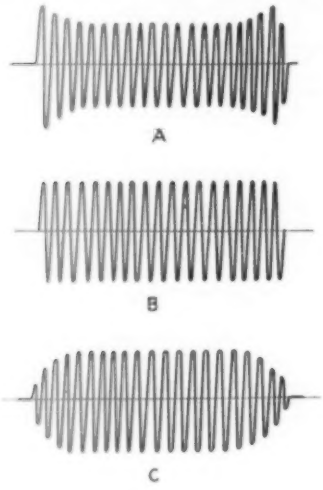


FIG. 1

SUGGESTING THE FORM OF THREE POSSIBLE WAVE TRAINS RESULTING FROM THE TRANSMISSION OF A DOT

At A the oscillation is represented as starting suddenly at high amplitude as the result of the peak voltage of the supply system reaching the tube instantaneously—a condition which would result from the use of a key in the grid, center-tap or plate leads without any "time lag" circuit. Serious thumps and a frequency "flip" would be caused. At B the oscillation is shown starting suddenly at its normal amplitude—a condition which could result from keying in the antenna circuit or from keying within the transmitter with insufficient inductance in the "time lag" circuit. The wave train C indicates a tapering of the amplitude at the beginning and end of the oscillation, the condition brought about by the use of a well adjusted lag circuit. In this case thumps would be almost completely eliminated though "chirps" would result in a self-excited transmitter if it was incorrectly adjusted.

7. If possible the plate load should be reduced appreciably or cut off entirely during the spaces.

There is not much doubt that these desirabilities can be attained under certain conditions. Unfortunately, however, it does not seem that these qualities can be "transplanted" into any transmitter in which the system is installed. It would seem that as much depends upon the condition in the oscillatory circuits of the transmitter as upon the characteristics of any keying method. It is on account of this that we have been unable to arrive at the point where we can specify any one system as the solution to the keying problem. And it is for this reason that we must attempt a comprehensive treatment of the considerations in order to make it more readily possible for the amateur to select the system which most suits his conditions and then to solve the minor problems which will be met in the adjustment of it.

The requirements with which we are to be particularly concerned in the occupation of our new bands are those numbered 1, 3 and 4 involving simplicity, constancy of frequency and thump elimination. It is almost too obvious to require mention that any system fails to provide a solution for the keying problem unless it is inexpensive and simple. Without these characteristics the system could never be generally and successfully adopted. Constancy of frequency is now a requirement of prime importance on account of the narrowness of the bands and the growing use of highly selective receivers. Signals of constant frequency can be held on the peak of a highly selective amplifier and read through interference which would swallow a signal that chirped or wandered over a kilocycle or so. The consideration of key thumps is listed in the "big three" since the problem of interference with broadcast reception must always be a concern of the amateur. In addition, though, we must remember that key thumps can constitute a source of interference even within our own bands.

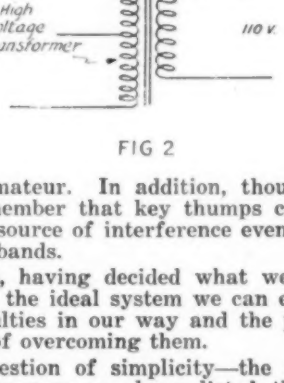


FIG 2

And so, having decided what we would expect of the ideal system we can examine the difficulties in our way and the possible methods of overcoming them.

The question of simplicity—the first of the problems as we have listed them—is really also the first in importance. Thump filters and other appendages have been devised from time to time but they have been used only by amateurs haunted by neighboring listeners or by particularly sincere or ambitious men. The arrangement in most general use has been a simple key which even if it was not perfect, at least chopped the signal into readable dots and dashes in the simplest possible fashion. Except in special cases it would now seem that the true "1929" transmitter cannot possibly be keyed with a straight key, and in urging every amateur to install some keying refinements we hope to be able to present at least some reasonably simple ones. At the same time we are obliged to admit that the

simplicity question is still inadequately answered. In the laboratory work we have found it a straight forward matter to arrange a near-perfect system providing enough chokes and resistors of the right values were available. We have been able to reduce the systems to a thoroughly practical form, however, only by sacrificing their effectiveness.

The operation of the practical keying systems is hampered in most cases first by the fact that few stations have a power supply with good regulation. In almost all instances the plate voltage and sometimes the filament voltage makes a dip when the tube takes its load. The frequency of the tube output is dependent to some extent upon the voltages and we are, therefore, immediately faced with difficulties in attaining the next important desirability—constancy of frequency. In many cases it is impractical to install a special heavy duty power supply line which would avoid regulation troubles and the keying system thus becomes entangled with considerations of the high voltage transformer, rectifier and filter system. Also it immediately is tied in with the problems of transmitter tuning, which, as we know, are concerned greatly with the reduction of frequency changes due to variation of tube supply voltages.

Yet another difficulty in the attempt to obtain frequency constancy is due to the fact that the frequency output of any but crystal controlled transmitters will vary as the heating of the plate changes. If, in keying, the load is to be removed from the

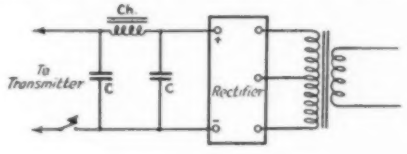


FIG 3

plate during the spaces, frequency changes will occur. If, on the other hand the keying system is so arranged that the load will be on the tube continuously, then the tube will heat more seriously than before and the net result will be to replace the irregular frequency changes by a relatively constant and probably more drastic one. On account of these considerations also, it is seen that the problems of keying are closely associated with those of transmitter tuning.

The question of key thumps rotates around the fact that consequential thumps result if the voltage in the antenna climbs to its full value at too rapid a rate. The key thump elimination problem for the amateur therefore consists in making some provision which will permit the antenna voltage to build up gradually. The making of this provision is made difficult by the fact that if the tube is caused instantaneously to oscillate at full amplitude, the antenna voltage, in the usual antenna, will build up too quickly. If the tube is made to climb into full oscillation slowly by introducing a lag in the supply circuits, further complications as introduced by the fact that the frequency will be changing as the supply voltages are climbing to their normal value. A rapid frequency "flip" will then be found at the beginning and end of each character. Careful tuning also is to help greatly in this

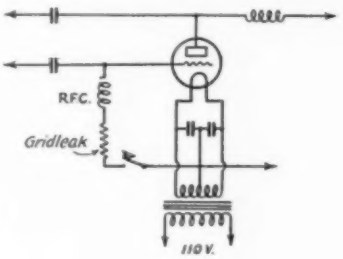


FIG 4

case. In the same connection we have another consideration which must be understood. When we speak of a 2,000-volt transformer we are referring to its effective or root-mean-square voltage. The voltage output of the transformer is, of course, varying constantly from zero to a peak value and back again and this peak value is 1.41 times that of the r.m.s. output. Now if the key is arranged in such a way as to disconnect the tube from the filter circuit during the spaces the condensers in the filter will become charged to the peak voltage of the unloaded transformer. Then when the key is closed, unless special precautions are taken, the tube will receive a special kick at the start of each character from this peak voltage. The result, far from being a gradual building up of oscillations, will be the sudden starting of oscillations of unusually high amplitude tapering, after a fraction of a second, to the normal value. Under these conditions a thump and a frequency "flip" of serious proportions would most certainly result.

And there is even another factor with which we are to be concerned in thump elimination. It is that when the contacts of the key open a spark occurs, this spark resulting in a thump. If the key is located where it breaks appreciable power it will be found that provision must be made for the reduction or prevention of this spark.

And here we find ourselves with a great many words behind us and nothing said as yet of practical keying. This is unavoid-

able, though, since we believe that we must insist that satisfactory keying can only rarely be accomplished by following a wiring diagram. It has been our conclusion that the amateur must know what he is trying to do with the keying apparatus in order that he may be able to arrange it and adjust it with the least difficulty.

The practical keying methods, to get down to brass tacks, can be resolved into four general divisions. They are:

(a) Interruption of the primary circuit of the plate supply transformer.
(b) Breaking of the high voltage supply to the plate.
(c) Variation of the mean grid potential —"blocking" of the grid by negative bias.
(d) Interruption of the oscillatory energy in the output circuits.

Other practical schemes involve a combination of two or even three of these.

Scheme (a) is limited to transmitters in which the time lag in the high voltage circuit is something less than about 1/50th of second—assuming that keying is to be at the usual hand speeds. If the lag was greater

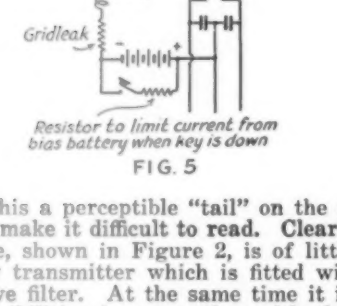


FIG. 5

than this a perceptible "tail" on the signal would make it difficult to read. Clearly the scheme, shown in Figure 2, is of little use in any transmitter which is fitted with an effective filter. At the same time it is full of possibilities in connection with the amplifiers of a crystal controlled set in which a simple filter usually is sufficient to obtain a pure note. Experiment has shown also that it could be effective when used with a High-C transmitter carefully tuned—for a transmitter of this type can also be made to give a note of excellent quality with but a small filter. In the case of "self-rectified" transmitters this scheme (a) is also of service, though the cushioning effect of a small filter is absent. Unless the transmitter is of low power there will be heavy sparking at the key contacts in any case. For this reason a relay with particularly heavy contacts is desirable.

Scheme (b), the interruption of the high voltage circuit, is the one obvious method of keying a transmitter equipped with an effective filter. It is, however, the scheme most likely to produce trouble unless precautions are taken. Let us examine the case of a straight key placed in the negative high voltage lead.

Assuming that the transmitter has been adjusted satisfactorily and that the key in Figure 3 is open, the condensers C will become charged from the transformer-rectifier system to almost the peak voltage of the transformer. At the moment when the key is closed the transmitting tube will receive this peak voltage and will break into oscillations of abnormally high amplitude. This first burst of activity will last only for an extremely small fraction of a second until the load taken by the tube reduces the charge on C to the normal voltage under load. At the moment when the load came on the transformer, the voltage output dropped as the result of poor regulation and after overcoming the lag introduced by the choke Ch. this drop appears at the tube, reducing the amplitude of its oscillation to the normal steady value. But this is only half the story for we know that changes in plate voltage cause changes in the oscillation frequency. When the supply voltage made its dive at the closing of the key not only did the amplitude of oscillation change but also the frequency output flipped simultaneously; the net result of the whole procedure being the production of a heavy thump due to the sudden starting of particularly heavy amplitude oscillations and a drastic frequency flip due to the change in supply voltage. At the opening of the key a flash would occur at the contacts resulting in another thump and frequency splash, probably of lesser proportions.

In order to overcome these troubles and reduce this system to a practical form it is now clear that we require:

1. A means of preventing the filter capacity from charging to the peak voltage of the transformer.
2. Some refinement to improve the regulation of the plate supply.
3. A reduction of the frequency change with plate voltage change in the transmitter.
4. Apparatus effective in reducing the flash as the key is opened.
5. The introduction of a time lag so that oscillations, even of normal amplitude, will not build up suddenly.

Since these requirements are common to most keying systems, we will postpone consideration of them momentarily.

Scheme (c), the blocking of the grid, is another sound method of stopping and starting oscillations for the work can be done at this point with less electrical effort than elsewhere in the transmitter. The simple connection of the key as in Figure 4, how-

ever, does not by any means constitute a "1929" type keying system. As in the previous case the filter capacity becomes charged to the peak voltage of the supply unit when the key is up. When it is closed the tube receives the same voltage kick as in the plate lead keying system and the same sort of thump and frequency flip result. The spark at the contacts is now very much less on account of the lower current in this circuit but other troubles are introduced by the fact that in some tubes the grid does not accumulate a sufficient negative charge when free to completely "block" it. The grid can be provided with an external source of negative charge to overcome this, as shown in Figure 5 but the major faults of the system still exist. With the possible exception of Number 4 the requirements for this system are the same as those of scheme (b).

The method listed as (d), the interruption of the energy in the output circuits, has the immediate advantage that the tube may oscillate continuously, so making it impossible for the filter to become charged to the peak voltage and so avoiding some of the difficulties due to poor regulation in the power supply. The arrangements shown in Figure 6 still have the disadvantage that the antenna is bumped into sudden oscillation and possess the ability to provide a heavy radio frequency spark at the contacts as the circuit is broken. The necessary refinements for this method could be listed as:

1. A means of introducing a lag in the building up of oscillation in the antenna.
2. Provision for the avoidance of flashing at the contacts.

OTHER CIRCUITS

Some possible combinations of two of these four methods, (a), (b), (c) and (d), are given in Figure 7. At A the double contact key or relay is arranged so as to break the primary of the high voltage transformer simultaneously with the negative high voltage circuit, the idea being to avoid permitting the filter capacity to become charged when the key is open. The arrangement shown at B is a combination of schemes (b) and (c). In this case the breaking of a single lead interrupts both plate and grid circuits. A great many other combinations are possible.

REDUCING THE SYSTEMS TO PRACTICAL FORM

In considering the attainment of the desirable refinements let us first talk of requirement Number 1—a means of preventing the filter capacity from charging to the peak voltage of the transformer. Of the basic keying systems only (a) the interruption of the plate transformer primary can be freed from this consideration.

Perhaps the most direct solution to the problem is that shown in Figure 8. In this case a double contact relay serves to disconnect the filter when the key is up. During the spaces the filter will—if the condensers are in good condition—retain its charge and only the normal voltage will be obtained when the key is closed. Troubles would be introduced if the two contacts did not open and close at exactly the same moment and for this reason careful adjustment of the relay would be essential.

The use of a double contact relay which breaks the primary of the high voltage transformer in addition to the negative high voltage lead is another method of preventing the filter capacity from becoming charg-

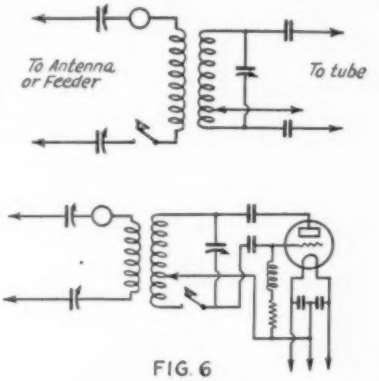


FIG. 6

ed to the peak voltage. As shown in Figure 7A a resistor can be placed across the contact in the primary circuit so that when the load is taken off the output of the filter the input voltage to it is reduced by an amount necessary to keep the voltage across the filter capacity constant at all times. A high voltage voltmeter is desirable in order to permit correct adjustment of the resistor R. The two relay contacts, in this arrangement, must always be adjusted so that the contact in the high voltage lead opens after that in the primary and closes before it, that is, unless they operate exactly simultaneously.

A simpler scheme is that shown in Figure 9. In this case a resistor is connected across the output of the filter so that there is a continuous current flow from the supply system. In this way the condenser is never permitted to maintain a charge equal to the peak voltage. Unfortunately, however, its charge will be somewhat higher than the normal operating voltage on load, its exact value being dependent upon the capacity of the condensers and the resistance of R. As R is reduced the voltage built up during the keying spaces is less but it does not come down to the normal operating voltage until the load drawn by R is equal to that taken

by the tube in operation. Then the voltage would stay constant only if R was removed at the instant that the tube started operation. Which simultaneous removal is rather impractical.

Considerations of simplicity, cost and reliability of operation it would seem, boil the situation of the peak voltage down to the use of a resistor across the filter output —the resistance and current carrying capacity of the resistor to be determined by the voltage of the supply and the permissible current drain from the plate supply

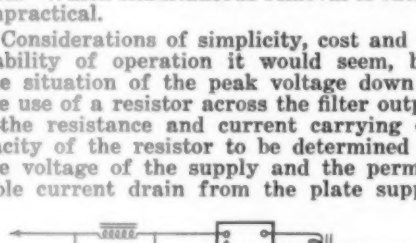


FIG 7

additional to that taken by the tube. A practical value of drain current through the resistor has been found to be about 25% of the tube plate current. For a transmitter employing a single UX-210 this would therefore be approximately 15 m.a. The value of the necessary resistance is obtained by Ohm's Law $R = \frac{E}{T}$. For a 500-volt supply it would therefore be 500 divided by .015, the result being about 33,000 ohms. In most cases, particularly if the new mercury vapor rectifiers are used, a much greater drain than this can be afforded and the necessary resistance so reduced. A resistance of 20,000 ohms, which would give a drain of 25 m.a., would be permissible in many cases. The points to remember are that as the resistance is lowered its effectiveness in reducing the condenser charge is increased; but that beyond a certain point, depending on the constants of the circuit, this increased effectiveness is at the expense of smoothing action in the filter; that the low drain currents require a somewhat expensive amount of resistance but that the high drain currents require resistance of higher current rating, making the expense probably of the same order. For the low current drains necessary with tubes of the UX-210 or UX-852 type, it is possible that a satisfactory resistor could be built up from "B eliminator resistors" obtainable from most "10 cent" stores. For the higher drain currents, grid leak resistors of suitable current rating would be effective.

THE REGULATION PROBLEM

And now, when we examine the second necessary refinement of our list we are faced with one bright fact. It is that the resistor which we have just mentioned is in itself a partial solution to this second problem. It certainly will serve to make a plate supply with poor regulation fair and a supply with good regulation better. At the same time it is not necessarily a complete answer. In order to attain good regulation in the supply circuits it is first necessary that the regulation of the supply line is good. Assuming that the filament is lighted from a separate transformer a simple check on this is to throw the tube load on and off by keying the transmitter; at the same time watching the filament voltmeter. If the filament voltage flickers more than about .1 volt, it is evident that something should be done about the supply line. The difficulty often can be overcome by running the plate transformer from one power outlet and the filament transformer from another. In the case of high powered transmitters, however, this may not be effective and the installation of a heavier supply line may be desirable. Providing the filament voltage stays constant during keying, attention should be given to the high voltage supply system. The most direct check of the high voltage regulation is to connect a voltmeter across the output and note the fluctuations in voltage caused by keying. With the Kenotron rectifiers usually employed in the amateur station, it will be found that an appreciable drop in voltage as the load is thrown on cannot be avoided. With the new mercury vapor tubes or a mercury arc rectifier, however, it should be possible to obtain a supply voltage which does not change more than 15% as the load is thrown on and off. In many stations a high voltage meter will not be available and for the check a d.c. milliammeter connected in series with the drain resistor at M in Figure 9 can be used. The plate meter will serve effectively for this purpose.

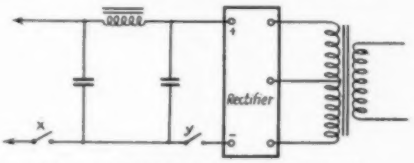
Aside from considerations of the rectifier tubes, poor regulation in the high voltage supply system can be caused by the use of a transformer or choke of too low a rating. We insist upon the desirability of using a high voltage transformer with a power rating of at least three or four times the power input with which the tube is operated. Similarly, in the case of the filter choke and any other chokes in the high voltage sup-

ply leads, we would suggest the use of chokes with a rated current carrying capacity of at least twice that of the normal plate current. The use of such over-sized transformer and chokes may entail more expenditure but the added cost will be completely justified. In this discussion we have assumed that the high voltage and filament transformers are separate instruments. If this is not so it is almost certain that difficulties will be faced in maintaining a constant filament voltage unless the rating of the combined transformer is a great many times that of the total load to be placed on it. Filament flicker, of course, affects the output frequency of any but crystal controlled transmitters. The lag between filament voltage and filament temperature makes the change in frequency from voltage fluctuations a relatively slow process and, as a result, serious frequency "chirps" can be caused as the transmitter is keyed. It is possible to arrange contacts on the key or relay to short a resistor in the filament circuit when the key is down, so compensating for the voltage drop on load, but the scheme is quite complicated. It is our firm belief that a separate filament transformer should be used in all cases.

PLATE VOLTAGE VS. FREQUENCY CHANGE

In our list of necessary refinements we have as the third item "A reduction of the frequency change with plate voltage change in the transmitter." Consideration of the extreme desirability of such a reduction and possible means of accomplishing it have been given lengthy treatment elsewhere in this and past issues of *QST*.[1] We will not attempt to cover the ways and means in detail in this discussion but we feel that we must stress the particular importance of the problem in the field of keying.

In the average poorly designed and poorly adjusted self excited transmitter it is possible for a 75% drop in plate voltage to cause a frequency change of the order of 15 kc. When the transmitter is keyed with a straight key in the center tap lead, it is therefore possible for a frequency flip to occur in which the output frequency swings over about 10 kc. Key clicks on the band in which the transmitter was working undoubtedly would result. The much sadder part of the story, however, is that if the keying system was arranged and adjusted with the greatest care so as to give a tapered wave train as in Figure 1C the frequency flip would be replaced by a slower frequency chirp extending over the whole 15 kc. and capable of greater interference than before. An approximate statement in summing up this condition is that *in any poorly adjusted self-excited transmitter keying must result in either clicks or chirps.* It is only when the frequency change due to plate voltage change is negligible that the tapered wave train so essential to the elimination of clicks can be used without creating a consequential chirp. And it is only when the self-excited transmitter is correctly arranged and adjusted that frequency change is reduced to a negligible quantity. Perhaps the greatest single factor in improving the plate voltage-frequency characteristic is the use of a High-C tank circuit. Other important requirements are; careful adjustment of grid leak resistance, grid excitation, antenna coupling and antenna tuning. Naturally, the monitor is of the greatest value in permitting the effect of these and all adjustments of the keying system to be observed.



x and y are relay contacts operating simultaneously

FIG. 8

REDUCING CONTACT SPARKING

As the fourth refinement we have listed the reduction of flashing at the key or relay contacts. If we could take a "slow movie" of the opening of the contacts we would find that at the moment when the contacts first separate the voltage behind the key builds up and arcs across the gap between the contacts. As the contacts continue to separate the length of the air gap is increased to the point where the voltage is insufficient to maintain the arc. If a path has been provided across the contacts which would momentarily provide a place for the current to go when the contacts first opened the arc would never have been started. Such a path can be provided without difficulty in the manner shown in Figure 10. The action of the condenser resistance combination could be explained very approximately by saying that when the contacts first part company the oncoming voltage finds that it is easier to flow through the resistance R into the condenser C than to break down the air gap between the contacts. By the time the voltage has fully charged the condenser C it finds that the contacts have opened too wide to permit it to jump the gap. The resistance has the effect of slowing down the charging rate of the condenser and its work is therefore of great importance. If it were not present the condenser would be charged almost in-

1. *QST*, August 1928 page 9. *QST*, September 1928 pages 9 and 25.

stantaneously and it is possible that there would still be time for the voltage to jump across the contacts before they had opened beyond the critical point. The resistance also serves to slow up the discharge of the condenser when the contacts are about to close, so avoiding a flash at the time when its charge is dissipated. Unfortunately no values for the capacity and resistance can be given which will serve under all conditions. A 1-μfd. condenser and a 400-ohm potentiometer type variable resistor usually will permit of satisfactory adjustment, however.

INTRODUCING A TIME LAG

The use of an inductance in the circuit being keyed in order to introduce a time lag and so taper off the wave trains has

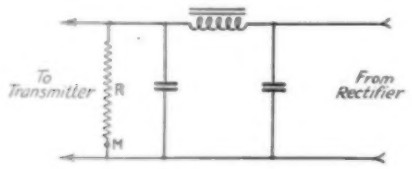


FIG 9

been common practice for many years. An inductance has the property of opposing any change in the magnitude of a current and its use is therefore the obvious method of introducing the necessary lag. In the past a great many thump filters have been described, each one having as its foundation an inductance in series with the grid or plate wiring in which a direct current is flowing. Unfortunately they have not been generally successful, chiefly on account of the difficulty of adjusting the inductance to the value necessary. On account of the poor frequency-plate voltage characteristic of many transmitters any choke which had sufficient inductance to taper the wave trains caused a frequency chirp or "tail." Chokes of lesser inductance avoided the chirp but left a click or thump. Further, it was found that constants given in a *QST* article on some successful arrangement did not work out satisfactorily in another transmitter. It was not appreciated by the amateurs using the systems that the desirable constants were dependent upon the constants of the filter used, the adjustment of the transmitter and the particular value of plate current at the moment. A wide variety of chokes of different values rarely exists in the amateur station and, as is testified by many hundreds of Information Service queries, thump filters were widely considered the bunque. The very same circuits are to be recommended in this discussion as have been suggested all along but there are two factors which should contribute towards making them more practical than they have ever been. First they are specified to be used with a transmitter in which the frequency change for a 100% change in plate voltage is not more than two or three hundred cycles—a condition which can be attained readily by using a High-C tank and by careful tuning. Then, the chokes are provided with a practical means of varying their inductance continuously. The time lag circuit consists therefore of a choke, sometimes used in conjunction with a condenser, the choke being shunted with a variable resistor. Some effective systems are shown in Figure 11. At A the key and time lag circuit are arranged in the plate lead and in consequence the choke should be capable of carrying the plate current without excessive voltage drop. Whenever possible a special transmitter type choke of between 5 and 10 henries should be used but in the case of a transmitter employing a UX-210 tube a "B eliminator" choke, or two of them in parallel, could be made to serve. In the arrangement in which the choke is in the grid circuit the primary of an audio frequency transformer can be put into service for the lower powered transmitters while a "B eliminator" choke can be used for medium or high powered sets. A suitable resistor for use across the choke is specified under Figure 11.

ADJUSTING THE SYSTEMS

The adjustment of any of these systems can be carried out most effectively with the aid of a monitor. The first move, of course, is to adjust the transmitter with the key down until the cleanest possible note is obtained. With any given filter this condition will be obtained when the frequency change due to plate voltage change is at a minimum. In getting the cleanest note one therefore puts the transmitter in the best

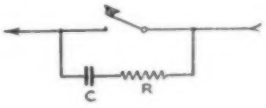


FIG 10

condition for successful keying. A valuable check on the adjustment of the transmitter can be made by connecting one or two lamps in series with the primary of the high voltage transformer so that the output voltage is reduced by, say 50%. A switch is then arranged so that these lamps can be shorted out. Opening and closing the switch then provides a sudden change in plate voltage and, if the transmitter is

poorly adjusted, the process will result in an appreciable change in the output frequency. By listening in the monitor the extent of the frequency change can be observed and adjustment can be continued until it is at a minimum. With the average self-excited transmitter fitted with a High-C tank the frequency change resulting from a sudden 50% plate voltage change can readily be reduced to the order of 1/350 per cent (200 cycles at 7,000 kc.) Under such conditions even a very gradual taper on the wave trains, which ordinarily would give a serious chirp, would be tolerable.

In adjustment of the shunt resistor R2 it is as well to listen with the monitor tuned to zero-beat with the transmitter for possible thumps and with the beat note at about 500 cycles for any possible chirp. No difficulty will be had in finding the adjustment half way between the thumps and chirps.

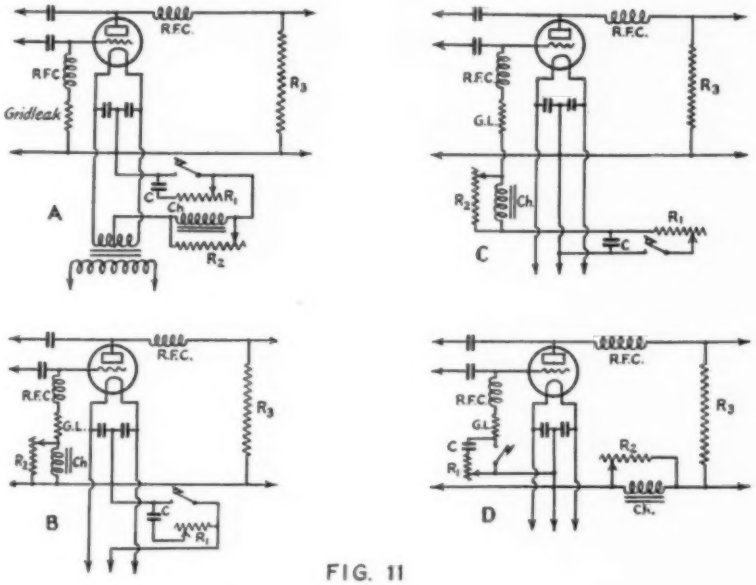


FIG. 11

SOME PRACTICAL KEYING ARRANGEMENTS INVOLVING THE USE OF AN INDUCTANCE TO PROVIDE A TIME LAG

At A the key and lag circuit Ch., R2 are connected in the center tap lead, so operating in both the plate and grid d.c. circuits. In this case the inductance Ch. must be capable of carrying the grid and plate currents without undue voltage drop. At B the key is in the center-tap lead while the lag circuit is in the d.c. grid lead. The inductance in this instance can be of much lower current rating than that used in A. The arrangement is therefore useful in cases where the available choke is not wound with sufficiently heavy wire to serve in the plate wiring. In the circuit C both key and choke are in the grid circuit a scheme which is particularly suited for high-current tubes with which key sparking, when the plate circuit is broken, is often difficult to eliminate. The arrangement D shows the key in the grid circuit and the lag circuit in the plate lead. This connection is well adapted for use with high-current tubes also since key sparking is readily eliminated and the lag circuit is in a position where it can play second part in reducing the possibility of sudden high voltage surges reaching the tube during keying. It is a useful arrangement when the available choke happens to be heavy enough for service in plate circuit. The resistor R2 (described in the text) performs a function essential to the successful operation of any of the circuits in reducing the peak voltage built up in the filter during the keying spaces.

R1—Variable resistor of wire wound or carbon-pile type, 400 or 500 ohms.

R2—When Ch. is of the order of 30-50 henries, 10,000 ohms. When Ch. is between 5 and 10 henries 5,000 ohms. For operation in the grid circuit or the plate circuit of low-powered transmitters resistors similar to the Bradleyohm are serviceable. For most plate circuits, however, wire wound resistors or carbon-pile resistors similar to the Bradleyleak are necessary.

R3—Wire wound resistor between 20,000 and 80,000 depending on tube used. See text.

C—.5 or 1 μfd. fixed condenser, voltage rating of at least half plate voltage when used in grid or center-tap. Voltage rating equal to filter condensers when used in plate lead.

Ch.—Audio frequency transformer secondary for use in grid circuit of low powered transmitter. Good "B Eliminator" choke for grid circuit of medium or high powered transmitter. When used in center-tap or plate lead a choke rated well above plate current of tube is necessary. Inductances between 5 and 50 henries are suitable providing R2 is of the correct value. In some cases a smaller choke may be found effective without R2.

KEYING THE RADIO FREQUENCY CIRCUITS

Experiment has indicated that it is not readily possible to key in series with the tank circuits or the feeder of antenna without producing thumps. At the same time such keying is particularly free from chirps and has the advantage that the plate supply system can be loaded continuously. In cases where interference with broadcasting is not a consideration they might well be put into service. Keying in the feeders or antenna as shown in Figure 12 provides the possibility of a particularly steady frequency when adjusted correctly but its use has been found satisfactory only on the 3,500 or 1,715 kc. bands. On the higher frequencies, even if a relay with low capacity contacts is used, it has been found that a back wave is radiated. In installing such a system it is important that the contacts are at a point of low voltage in the system. Perhaps the best plan is to place the relay within six inches or so of the antenna coil, adjusting the series condensers until the voltage node is at the center of the inductance. A neon bulb is almost indispensable in determining the location of the node.

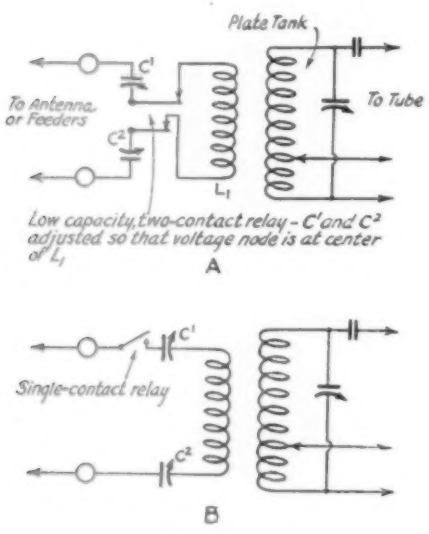


FIG. 12

KEYING AT A VOLTAGE NODE IN THE ANTENNA OR FEEDERS—A SCHEME RECOMMENDED ONLY FOR THE 3,500- OR 1,715-KC. BAND

When the series condensers are adjusted so that the two r.f. meters show the same reading there will be a voltage node near the center of the antenna coil and sparking at the relay contacts in circuit A will be at a minimum. What is more important, the capacity between the open contacts, under these conditions, will be least effective in permitting the radiation of a "back-wave." In scheme B a single contact relay is used and by the manipulation of condensers C1 and C2 it is possible to bring the voltage made right at the relay when sparking and the "back-wave" may be less noticeable than with scheme A. The location of the node can be found conveniently by listening to the transmitter in the monitor then touching the antenna or feeder wiring at different places with a screw-driver. When the location of the voltage node is touched the least frequency change will be caused. Neither system is particularly free from thumps though the keying can be made unusually "clean".

SPOILING A GOOD KEYING SYSTEM

One of the most important of many unsolved problems in the self-excited transmitter is the elimination of the frequency changes resulting from changes in plate temperature. In any self-excited transmitter the frequency can be held extremely constant, once the tube has heated fully, just so long as it is left in full oscillation. Unfortunately a keying system which changes the load on the tube also changes the plate temperature and some frequency shift results. If the system is one which permits the tube to oscillate continuously, the plate heats more rapidly and attains a higher temperature, making the result about as sad. The use of a High-C tank is of considerable value in reducing the trouble on account of the fact that the tube capacity is then a lesser percentage of the capacity across the tank coil. Even so, the difficulty still exists. At the moment we find that our only recommendations are that the tube is always operated so that the plate is never run at the temperature which shows color when the filament is suddenly switched off. In High-C transmitters, providing the input does not exceed the tube rating, this condition can be obtained readily.

Another way in which keying can be made to wreck a good signal is by mounting the key or relay where it will cause the transmitter to vibrate. It is very desirable that the key be mounted on a table separated from that on which the transmitter is located. When a relay is used it also should be on a separate mounting, preferably one attached firmly to the wall. An alternative scheme involves mounting the relay on rubber sponges.

The relay itself is an important item. In any system where keying is accomplished in the radio frequency circuits a relay is essential to avoid hand-capacity effects. When keying is performed in the plate circuit or the center-tap of a transmitter operating from more than 500 volts the use of a relay is also of the greatest importance. In fact, it is considered good practice to use a relay in all keying systems.

SOME SPECIAL SYSTEMS

The keying of a well adjusted master-oscillator-amplifier transmitter and particularly that of a crystal controlled transmit-

ter is in general simpler than the keying of self-excited transmitters since the frequency-plate voltage change is not a consideration. Thump elimination, in these cases, is the one important object and it is simplified greatly by the fact that the wave trains can be tapered without serious frequency chirp. The amplifier of a master-oscillator transmitter can be keyed in the plate circuit though this requires the connection of the key and time lag circuit in the positive high voltage lead if the oscillator and amplifier are operated from a common plate supply. A relay would be essential in such a case to avoid the danger of receiving a shock. It is probably preferable to arrange the key and lag circuit in the amplifier grid lead as in Figure 13.

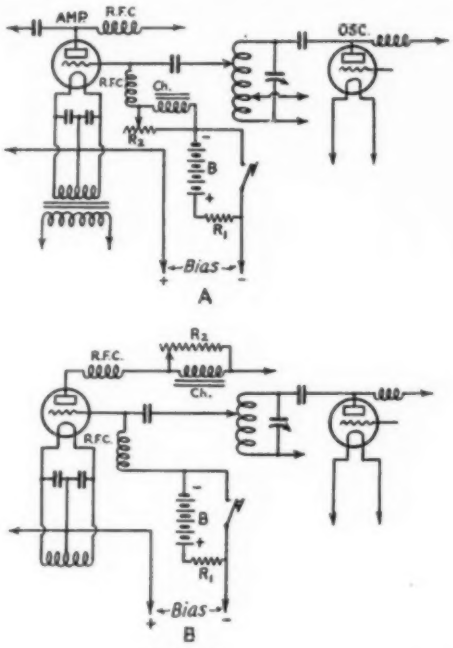


FIG. 13

KEYING SYSTEMS PARTICULARLY SUITED FOR USE WITH M.O.P.A. OR CRYSTAL CONTROLLED TRANSMITTERS

In the circuit A the time lag unit is in the bias lead to the amplifier grid. In most cases the mere opening of the grid circuit will not prevent the flow of amplifier current and for this reason the battery B is included. Its purpose is to hammer the amplifier grid negative when the key is up. The resistor R1 is used to limit the current flowing from B through the key when it is down. A 5,000 ohm gridleak will serve when B does not exceed 45 volts. A proportionately higher resistance is required when B is of a higher voltage. B is adjusted with the key up until the amplifier plate current is zero.

The connection of the lag circuit in the high voltage supply to the amplifier as in circuit B is desirable when medium or high power is used in order to provide a "cushion" against plate voltage surges during keying. Ch. and R2 are as specified under Figure 11.

Similar arrangements can be used for the crystal controlled transmitter.

Other more complex arrangements could be drawn up in dozens—the circuits given represent but a few of the hundreds of possible variations. A great many others have appeared in *QST* from time to time and undoubtedly will continue to appear. The important points are just that all of them are aimed to accomplish the same result and that it is an understanding of the objectives and possible means of attaining them which will be of the greatest service in the adjustment of any of them or the evolution of others.

Standard Frequency Transmissions From W9XL

Schedules for February

Schedule "A"		Schedule "B"	
Central Standard Time (PM)	Frequency in kc.	Central Standard Time (PM)	Frequency in kc.
8:00	7,300	3:00	30,000
8:12	7,225	3:12	29,000
8:24	7,150	3:24	28,000
8:36	7,075	3:36	14,400
8:48	7,000	3:48	14,300
9:00	4,000	4:00	14,200
9:12	3,750	4:12	14,100
9:24	3,500	4:24	14,000

Division of Time

4 minutes—CQ CQ CQ de W9XL W9XL W9XL.

3 minutes—series of letter "d" with the dash about five seconds long and broken every half minute for station call letters.

1 minutes— —frequency——kc.

4 minutes—time allowed to change to next frequency.

DATES OF TRANSMISSION

February	Schedule
3d	"B"
8th	"A"
22d	"A"

All O.F.S. should use these transmissions to keep their frequency meters calibrations within the required limits of accuracy. It will be appreciated if you will send us a report on your reception of these signals.

See page 8 of the November issue of *QST*.

—*H. P. W.*

Strays

There is another reason why you should "pin" an ARRL emblem to your car. W5AMK had one on his car and five hours after it had been stolen, it was recovered by the police. He believes the yellow and black diamond had a great deal to do with it.

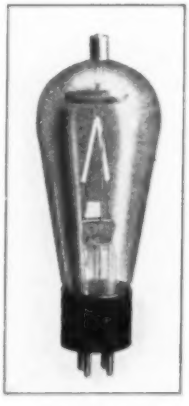
A New Type of Rectifier Tube for Amateur Use

O. W. Pike* and H. T. Maser*

The matter of obtaining suitable rectifiers for plate supply systems for amateur transmitters has been one upon which much work has been expended. Practically all rectifiers have some bad disadvantages: the chemical rectifier is cumbersome and sloppy, the Kenotron has a high internal drop and the mercury arc requires a large amount of accessory equipment. This article describes a new mercury vapor, thermionic tube that combines the simplicity of operation found in the Kenotron with the low internal drop characteristic of the mercury vapor tube. It bids fair to become the most important development in rectifiers that the amateur has yet seen and at this time when we are looking about for suitable power supply systems for our "1929" transmitters, it is of extreme importance to us.—Editor.

THERE has recently been developed for amateur use a new rectifier tube known as the UX-866, involving a new principle of operation. This tube is known as a hot cathode mercury vapor rectifier, and the purpose of this article is to tell something of its characteristics and the best conditions for its use.

The new tube employs a hot cathode of the "Wehnelt" type and contains mercury vapor. It differs from the usual mercury arc tube in two ways. First, it operates at relatively low temperatures so that the vapor pressure of the mercury is low. This results in a high breakdown voltage between the electrodes in an inverse direction. Second, the rectified current is made up of electrons emitted from the filament rather than from a pool of mercury. In this respect the tube is similar to the ordinary high vacuum two-electrode rectifier tube but it differs from the high vacuum tube in that the ionized mercury vapor neutralizes the electron space charge around the filament. This means that where in the vacuum tube a hundred volts or more might be required to give a certain plate current the mercury tube will give the same current with only about 15 volts between plate and filament. Of course, just as in the vacuum tube the current can never be greater than the electron emission of the filament, but up to this point the voltage necessary to pass the current is practically independent of the current and is never more than about 15 volts.



RADIOTRON UX-866

This tube borrows a little from most all the types with which we are familiar. The filament is of the flat ribbon coated type drawing 5 amperes at 2.5 volts. The plate is about as large as a quarter dollar and its edge is turned down towards the filament. The plate lead terminates in a cap such as is found on the 222 and the glass envelope is similar in size to the 210.

It may seem strange that the current can increase without an increase in voltage until it is remembered that as the current increases more positive ions are formed which further neutralize the electron charge around the filament and permit additional electron current to flow.

The cathode is a coated ribbon filament which quickly assumes its operating temperature when the filament voltage is applied. This type of filament is especially well suited for operation in mercury vapor and is not harmed by high inverse voltages; that is, voltages in a reverse direction during the half cycle when no current is flowing. As the voltage drop within the tube is always low there is no harmful ionic bombardment of the filament, since the ions which do strike the filament are moving slowly.

The low voltage drop in this tube results in increased d.c. rectified voltage for a given a.c. supply and also improves the voltage regulation characteristics of the rectifier. The only reduction in rectified voltage when the load is increased is due to the drop in the transformer and filter windings. The low tube drop also allows the use of circuits employing rectifier tubes in series which is not usually a desirable connection when using high vacuum tubes.

The low drop is largely independent of tube geometry so that a simple inexpensive electrode structure is possible. This results in a somewhat smaller tube than a high vacuum tube having equivalent output.

As with high vacuum thermionic tubes, this type of mercury rectifier does not re-

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quire the usual starting mechanism, as electron emission is available as soon as the filament is lighted.

The tube is designed so that under normal voltage and current conditions, its operation is independent of temperature up to an ambient temperature of 50° C. (122° F.) Higher temperatures are not usually encountered but if under special conditions the ambient is greater than 50°, an air blast

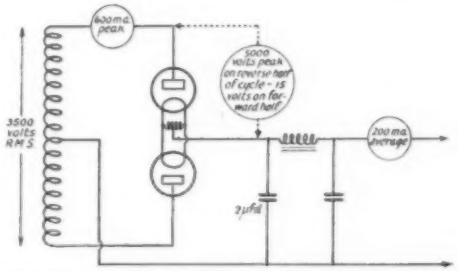


FIGURE 1. TWO TUBES ARE USED IN A FULL-WAVE RECTIFYING CIRCUIT

With condenser input to the filter, the peak current through each tube is approximately three times the average output current from the two tubes. This filter arrangement should be used where the output voltage is relatively high and the output current is low.

should be used in such a manner as to cool the lower portion of the tube.

The method of rating this tube differs from that used in the past with vacuum tubes and may require some explanation. Heretofore, rectifier tubes have usually been rated on the basis of a.c. supply voltage and the d.c. load current. Occasionally the d.c. voltage was also given. This method was very convenient where there was little variation from the usual single-phase full-wave circuit. However, with the low voltage drop of the mercury vapor tube it is possible to make use of a variety of circuits, some of which involve the use of tubes in series. The former method of rating then becomes incomplete and often misleading. For this reason the rating of this new tube is stated in terms of the fundamental limits of the tube. There are two such limits. The first is the maximum peak inverse voltage which is the safe flash back limit which the tube will stand while operating within the rated temperature range. The other limit is the peak current through the tube, which is dependent on the emission available. In the UX-866 these are 5,000 volts and 0.6 amperes respectively.

The peak inverse voltage in single phase circuits may be taken as 1.4 times the total transformer voltage (r.m.s. value). The peak plate current is not as easy to determine as it depends upon the filter constants. With a large condenser (greater than 2 μfd.) on the rectifier tube side of the filter (Fig. 1), the peak current *per tube* is roughly three times the load current *from two tubes*. With a large choke (greater than 10 henries) on the rectifier tube side of the filter (Fig. 2) the peak current *per tube* is approximately 1.5 times the load current *from two tubes*.

No attempt will be made here to include all the rectifier circuits sometimes used with this tube, but the accompanying table shows the ones most useful on single phase circuits. However, three phase circuits are often desirable when three phase power is available.

This table assumes the use of several well known transmitting tubes. For every case the maximum allowable plate voltage for c.w. use is chosen except for the UX-852 where both 2000 and 3000 volts are listed. The maximum safe input current to the transmitting tube is also assumed. A suitable rectifier is then shown for each transmitter. It is interesting to note that either two or four UX-866 tubes will supply every ordinary need for plate power for amateur transmitters.

The last two circuits are of special interest, where greater than 2000 volts is required. Here two tubes are used at each

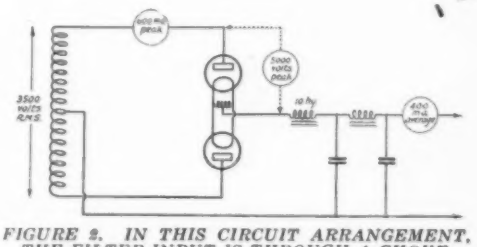


FIGURE 2. IN THIS CIRCUIT ARRANGEMENT, THE FILTER INPUT IS THROUGH A CHOKE

Here the peak current through each tube is only approximately one and a half times the average output current obtained from both tubes. A sacrifice in output voltage results, though, and this type of filter should be employed in cases where the output voltage may be low but where high output current is necessary.

end of the transformer so that full-wave rectification is accomplished without the use of a transformer mid-tap. As this connection makes full use of the transformer without increasing the peak inverse voltage, twice the usual voltage may be obtained. Two tubes act in series with this circuit, but this does no harm as the combined voltage drop is very low.

It is interesting to see how the choice of filter affects the output obtained. For instance, in supplying the UV-203-A tube, comparatively low voltage but high current

is required. Here a choke is used next to the tube to reduce the peak tube current at the expense of the voltage output. In the case of the UX-852, at 2000 volts, lower currents are required so that a condenser

LAYOUT FOR AMATEURS

OSCILLATOR			RECTIFIER			RECTIFIER DIAGRAM	⊛ FILTER
TUBES	VOLTAGE	AMPERE	TUBES	TOTAL TRANSFORMER VOLTAGE	PEAK PLATE CURRENT PER TUBE		
UX-210 ○	450	0.060	2 UX-866	1250	0.090 ★		120-VOLT DROP
UV-211 or UV-203-A ○	1250	0.175	2 UX-866	3500	0.265		350-VOLT DROP
UX-852 or UX-860 ○	2000	0.100	2 UX-866	3500	0.300		200-VOLT DROP
UX-852 or UX-860	3000	0.100	4 UX-866	3500	0.150		200-VOLT DROP
UV-204-A	2500	0.275	4 UX-866	3500	0.400		550-VOLT DROP

NOTES.
⊛ 1000 ohms chosen as resistance of typical choke
★ Approximate values
○ Two tubes may be used in parallel without overloading rectifier

TABLE INDICATING VARIOUS USES OF THE UX-866

The above table indicates a suitable rectifier and filter arrangement for transmitters employing six different types of tubes commonly used by amateurs. It should simplify greatly the problem of picking the correct combination for most amateur transmitters. The cases treated are varied enough to allow other combinations to be determined without much guesswork being involved.

may be used next to the tube without exceeding the peak tube current limit. The result is a higher output voltage than in the former case. The only difference between the two cases is whether a choke or a condenser is placed on the rectifier tube side of the filter.

There are a few operating limits which might be emphasized here, although they are covered in the instructions accompanying the tube.

The filament of the UX-866 tube should always be operated at rated voltage. Less than this voltage may result in a high voltage drop across the tube with consequent bombardment of the filament and eventual loss of emission or even puncturing of the bulb. Greater than rated voltage will shorten the life of the filament by burn out.

A UX base is provided, the grid and plate terminals being anused.

During shipment the mercury may have become spattered onto the filament and anode and therefore when tubes are first placed in operation the filament should be lighted at normal temperature for a few minutes with no plate voltage applied to the tube in order to properly distribute the mercury. Once in service, it should not be necessary to repeat this process.

When starting rectifiers using these tubes, at more than 2100 volts peak inverse the filament should be lighted for 30 seconds before plate voltage is applied. This may be automatically accomplished by a time delay relay in the plate circuit.

During life the bulbs will eventually darken. This is not an indication of the end of life and tubes should not be discarded on this account.

Strays

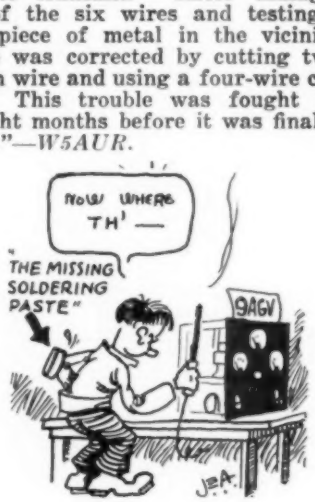
A new printing has been made of the Constitution and By-Laws of the A.R.R.L., revised to March 1928. A copy will be mailed upon request to any member of the League.

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An idea of controlling regeneration in the short-wave receiver is suggested by W8AXW. A variable resistor of 50,000 ohms maximum is connected in series with a 250 μμfd. fixed condenser, the two being shunted across the tickler coil. The rotating arm of the resistor is connected to the side of the coil going to the "B" battery so as to reduce "body capacity effects" This method, he states, gave as good control as the use of a "throttle" condenser with the added advantage that it caused practically no detuning when being adjusted.

—•••—

"With two or more wires in a counterpoise, care should be taken that this arrangement does not act as an inefficient Hertz and absorb most of the energy from the set. In one particular station, the counterpoise was of such dimensions that it resonated to the wave on which it was desired to transmit. After taking down four of the six wires and testing about every piece of metal in the vicinity, the trouble was corrected by cutting two feet off each wire and using a four-wire counterpoise. This trouble was fought against for eight months before it was finally conquered."—*W5AUR.*

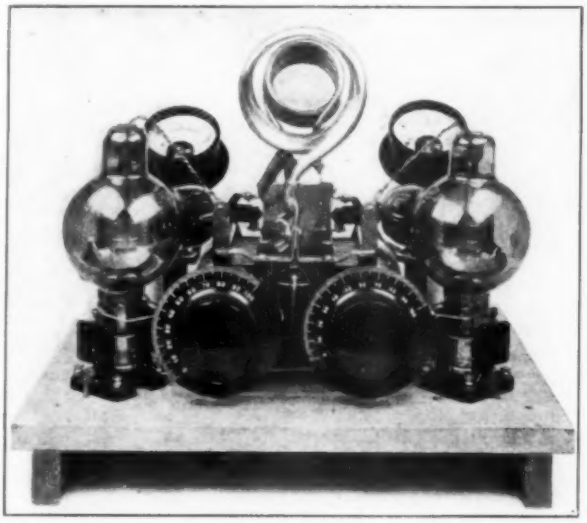


An Examination of A. C. Plate Supply

Considerations Governing the Use of Self-Rectification in Our New Bands and Precautions Which Must Be Observed in Its Employment

By Ross A. Hull*

JUST as soon as the findings of the Washington Conference had seeped into our minds, reconciling us to the coming of a new phase of amateur radio, we came to think that the forthcoming restrictions were to spell the doom of all self-rectified transmitters except those employing crystal control. And our sorrow at the thought was all the more acute on account of our knowledge that the self-rectified transmitter, as the result of its simplicity, was an important part of amateur station equipment. Our belief, however, now appears to have been premature. Experiment with a variety of self rectified transmitters in the A.R.R.L. Laboratory has indicated that the signals from such transmitters most certainly can fulfill the requirements of a "1929 type" signal *if only the transmitters are designed and adjusted correctly.* At the same time, the fact that the signals from these transmitters are so much more dependent upon careful design and operation of the equipment than is the case with d.c.-supplied sets makes it necessary to emphasize to the prospective user of self rectification the precautions which are to be so important. Very clearly, the lawful existence of the self-rectified transmitter must be dependent upon the extent to which amateurs are willing to take care of the necessary refinement and adjustment of the apparatus involved.



A SELF-RECTIFIED TRANSMITTER WITH A "1929 TYPE" SIGNAL

Fitted with a High-C tank and a means of matching the frequencies generated by both tubes such a transmitter is found to perform in the 1929 manner providing it is adjusted with great care. The grid condenser, not visible in the other photographs can be seen between the two tank condensers immediately under the wing nut of the coil mounting.

The whole trouble rotates around the fact that the frequency of the output of the self-excited transmitter is influenced by the plate voltage—that in any such transmitter in which the plate voltage is alternating constantly from zero to maximum the attainment of a near-constant frequency is at once difficult. The output frequency of a well adjusted crystal-controlled transmitter on the other hand, is not dependent on the plate voltage of the amplifier tube or tubes. Let us, then, use its performance as a standard against which to compare those of the other types of transmitters to be considered.

Assuming that the amplifier of the crystal transmitter is a single tube supplied with an alternating plate voltage, its output, neglecting the side-bands, could be described as chunks of energy, all on one frequency, generated every other 1/120th second (on the positive half of each cycle of the supply frequency). This output could be indicated as the horizontal lines A of Figure 1.

In contrast to this we can consider the output of a single self-excited tube operating from the same plate supply. In this case the frequency is varied with each change in the plate voltage and, since the plate voltage is alternating continuously

*Associate Technical Editor, *QST*. In Charge A.R.R.L. Technical Development Program.

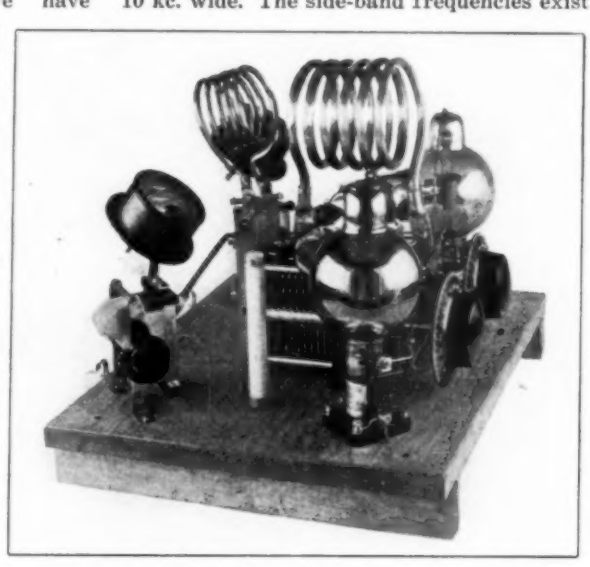
the frequency of the output is never constant. If the transmitter is not particularly well arranged or adjusted we have found that the frequency change resulting from a 100 percent voltage change can be of the order of 15 kc. on the 7,000-kc. band. As more representive of the average poorly adjusted transmitter we have shown this in Figure 1 as 10 kc. The curves B in that figure, again neglecting side-bands, represent the possible frequency output of this poor self-excited self-rectified transmitter. Whenever the tube is oscillating, its frequency is diving across a piece of valuable territory wide enough to accommodate half a dozen good amateur signals. The signal from the crystal-controlled transmitter, though it is broken into innumerable pieces 1/120 of a second long, is all on the one frequency and in consequence the note in the receiver will be a musical one. This effect could be likened to playing a single note on a piano every other 1/120 of a second. The note produced by the signal from the poor self-excited transmitter, however, cannot possibly have a musical character since the effect is then to be likened to playing every note on the piano during each 1/120 second! It is hardly to be wondered at that the average self-rectified signal is a wretched splutter splashing itself over five or six times more territory than it has any right to occupy.



FIG. 1

The Curves C in Figure 1 represent the output of a single tube, self-excited self-rectified transmitter in which a successful attempt has been made to reduce the effect of plate voltage changes over the frequency. In this case the frequency "flutter" resulting from the constantly changing plate voltage has been reduced to the order of 150 cycles—a condition which has been obtained without difficulty in practice—so causing the frequency to "flutter" over only one hundredth part of the territory cluttered up by the poorly adjusted transmitter B.

The influence of the side-bands over the interfering capabilities of the signal is indicated in Figure 2. At A the oscillation frequency of the well adjusted crystal controlled transmitter is shown as a single vertical line occupying an insignificant amount of territory. On either side of it are represented the side-band frequencies produced by the modulation of the 60-cycle plate supply and its harmonics. The amplitude of the harmonics beyond the second is of a very low order and, for the purpose of facilitating the comparison, they can be neglected. We can, therefore, consider the crystal-controlled transmitter as emitting a signal 240 cycles wide. The diagram B is a similarly approximate representation of the output of the poor self-excited transmitter. In this case the fluttering oscillation frequency occupies a band of frequencies 10 kc. wide. The side-band frequencies exist in this case also and since they follow the oscillation frequency in all its flutterings they can be shown alongside the outermost limits of the oscillation frequency by the single vertical lines. Again taking into account the side-bands produced by the fundamental supply frequency and its second harmonic we see that the signal from this transmitter occupies 10,240 cycles! Diagram C, representing the output of the "1929" self-excited, self-recti-



THE SELF-RECTIFIED TRANSMITTER IN PLAN

Showing, in particular, the mounting of the tank coil, the antenna coil and antenna condensers and meter and the radio frequency choke.

fied transmitter, shows the oscillation frequency fluttering over 150 cycles and carrying its side-bands as before. The territory occupied in this case is now but 390 cycles.

Complications are introduced by the use of full-wave self-rectification—when one tube is made to oscillate on one half cycle of the supply frequency and another tube on the other half. The chief trouble is that the two tubes in the average present-day transmitter do not generate the same frequencies.

Figure 3 provides a comparison of the output of a crystal controlled transmitter, a poor self-excited set and a good one—each employing full wave self-rectification. At A, as the standard of comparison, is indicated the output of the crystal transmitter. As before, the oscillation frequency is indicated by a single vertical line with the side-band frequencies similarly indicated on each side. In this case, however, the most important side band frequency is 120 instead of 60 cycles since both halves of the supply cycle are being utilized. Further, the second harmonic now produces side-band frequencies, at 240 cycles on each side. The territory occupied by the signal, again neglecting harmonics other than the second, is now seen to be 480 cycles or twice that occupied by the half-wave transmitter.

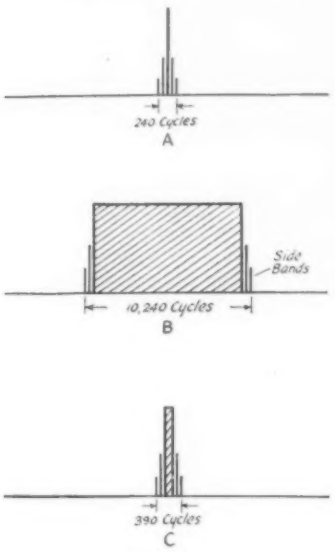
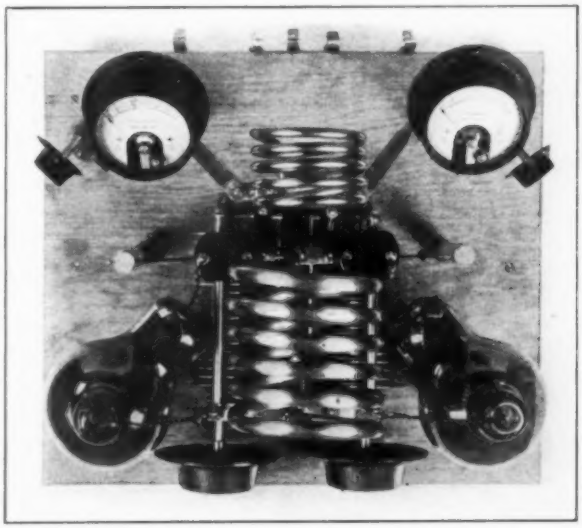


FIG 2

At B is seen a representation of the actual output of one transmitter built in the laboratory as a typically poor transmitter fitted with average tubes and poorly adjusted.



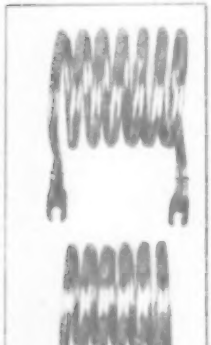
THE SELF-RECTIFIED TRANSMITTER IN PLAN
The symmetrical arrangement of the apparatus is apparent in this view.

The oscillation frequency produced by one of the tubes fluttered over the frequencies shaded by horizontal lines while the other tube, on account of differences in its characteristics, produced frequencies fluttering over the territory indicated by the vertical shading. In this case the signal, including the two main side-bands, occupied a band of frequencies 23,480 cycles wide! By fitting this transmitter with a High-C tank and by tuning it carefully the frequency flutter of each tube was reduced to the order of 200 cycles but the band of frequencies produced by each tube was still separated by approximately 1,400 cycles. The effect was that indicated at C in Figure 3. One tube was producing frequencies fluttering over the shaded area "a" while the other tube was emitting frequencies covering the territory "b". Each tube of course had its own set of side bands. The equivalent total frequencies covered in this case was 2280 cycles. Reconstruction of this transmitter to obtain mechanical symmetry and to permit the adjustment of the frequencies produced by each tube resulted in an output similar to that indicated at D. In this case the frequencies emitted by each tube were almost exactly similar, the width of the flutter was reduced to about 150 cycles, and the total territory cut down to the order of 530 cycles.

In all of this discussion, of course, the

representation of the character of the signals are approximate only and quite incomplete. They are intended only to bring out two points of major importance.

(a) That the side-band frequencies produced by a heavily modulated low frequency plate supply cause interference which is quite infinitesimal beside that resulting from the frequency flutter in the average present-day self-excited transmitter.



TANK COILS FOR THREE BANDS

The upper coil, used on the 3,500 kc. band consists of seven turns of copper tubing 3/8" outside diameter. The inside diameter of the coil is 3¾". The center coil, for 7,000-kc. operation consists of six turns of similar tubing. The inside diameter in this case is 3". The 14,000-kc. coil is of three turns with an inside diameter of 2½".

(b) That the full-wave self-excited transmitter is likely to cause more interference on the amateur bands than the half-wave transmitter since the two tubes usually produce two separate groups of frequencies, and because the important side band frequencies are twice as far apart.

At the same time it should be understood that the capabilities of the self-rectified transmitters in interfering with broadcast reception are not influenced greatly by frequency flutter and that of the two broadcast interference factories the half-wave transmitter probably would be the more formidable.

Let us now examine some ways and means of reducing frequency flutter and of setting the output of the two tubes to the same frequencies. The ideal method, of course, is to use crystal control with d.c. on the crystal tube and the a.c. on the amplifiers. No complaint could surely be issued against the signal from such a rig, correctly adjusted. With self-excitation the problem is a much more difficult one. The first move, we believe, should be the arrangement of a particularly High-C tank circuit. In this way the efficiency of the transmitter will be lowered appreciably but the changes in output frequency resulting from variations in plate voltage will be reduced to such an extent that the loss of efficiency in the transmitter itself is compensated for by the concentration of energy within a narrow band of frequencies and the resulting improvement in signal at the other end.

There appears to be some misunderstanding concerning the use of High-C circuits which has led to the suggestion that while High-C is satisfactory for tubes such as the UX-210 or UX-203-A its use with the higher impedance UX-852 results in excessive loss. The fact of the matter is that the L/C ratio which will give a certain degree of effectiveness in flutter reduction for a tube of high impedance or low capacity or both differs greatly from the L/C ratio of similar effectiveness for a tube of low impedance or high capacity or both. With any type of tube it should be possible to

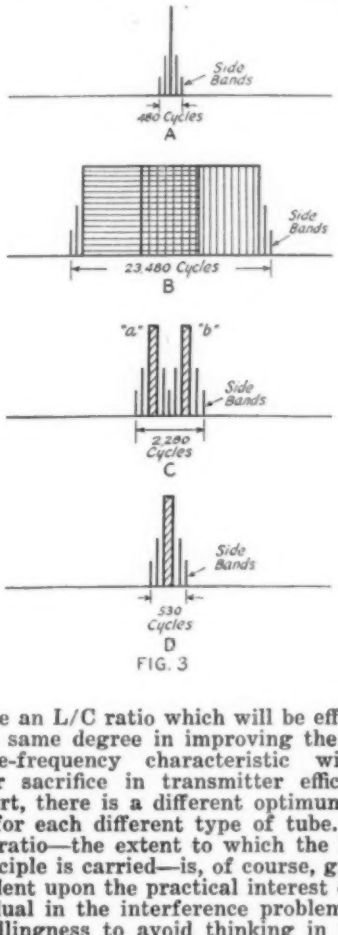


FIG. 3

provide an L/C ratio which will be effective to the same degree in improving the plate voltage-frequency characteristic with a similar sacrifice in transmitter efficiency. In short, there is a different optimum L/C ratio for each different type of tube. The exact ratio—the extent to which the High-C principle is carried—is, of course, greatly dependent upon the practical interest of the individual in the interference problem, and his willingness to avoid thinking in terms of antenna current. The amateur can rest assured, however, that the High-C principle has a thoroughly sound theoretical foundation. We hope to discuss it at some later date.

The particular apparatus chosen for the tank circuit in the transmitter illustrated consisted of copper tube inductances of the dimensions shown and two Type 199 Cardwell condensers connected in parallel. It will be noticed that the inductances are larger than those used in the UX-210 High-C transmitter[1]. In the construction of the transmitter this tank circuit is arranged between the two tubes in such a way as to permit almost exact symmetry in the grid, plate and filament connections. The complete circuit used is given in Fig. 4. It can be seen that it is similar to the self-rectified circuits which have been used all along. The only important difference is in the arrangement of the filament wiring to provide a means of adjusting the oscillation frequency of the two tubes to the same figure. Each tube is provided with its own pair of filament by-pass condensers and the center-tap lead between them is made of a bare copper wire on which slides the filament clip return T, from the inductance. In the photograph of the front of the transmitter this lead can be seen between the two dials and at the by-pass condensers. The moving of the clip on this lead from the center position changes the frequency of one tube up and the other down so permitting them to be matched. Other schemes are possible such as the use of variable plate blocking condensers[2], individual variable grid condensers, small variometers in the grid or plate leads, or small condensers connected between grid and plate of one or both tubes. Many such schemes were tried in the experimental transmitters built but all of them had the disadvantage that any change in the constants in one tube circuit shifted the frequency of both tubes in the same direction. The frequency of the tube being adjusted moved faster than that of its mate but it was necessary to cover much territory before the frequencies eventually were brought to the same spot. The arrangement used in this transmitter is, admittedly, a crude one. It does permit the two frequencies to be brought into line, however, with much less difficulty than was experienced in the use of other methods.

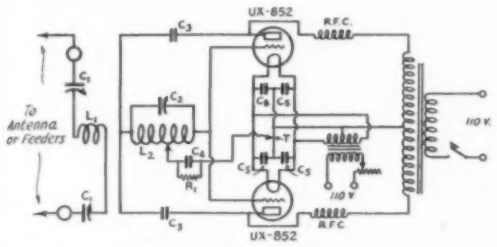


FIG. 4. THE CIRCUIT USED IN THE SELF-RECTIFIED TRANSMITTER

C1—350 μμfd. receiver type variable condenser.

C2—Two 350 μμfd. Cardwell transmitting condensers in parallel. A single condenser of about 500 μμfd. with sufficient plate spacing would be satisfactory.

C3—2,000 μμfd. fixed condensers (5000 volt rating)

C4—250 μμfd. grid condenser (5000 volt rating)

C5—2,000 μμ fd. fixed condensers (500 volt rating)

R1—20,000 ohm grid leak.

L1—Antenna coil of copper tubing ¼" outside diameter. 5 turns should serve for most antenna or feeder systems.

L2—Tank coils, illustrated and described elsewhere.

R.F.C.—160 turns of 28 gauge d.c.c. wire on wooden dowel rods 5/8" diameter.

The mounting of the remaining apparatus in the transmitter can be seen in the illustrations. The arrangement can, of course, be modified in a great many ways to suit the likes of the individual. The important point is just to preserve the nearest possible approach to exact symmetry in the endeavor to make wiring not common to both tubes, of the same length. If this is not done the frequency generated by the tubes may differ to such an extent that the provision of a satisfactory means of bringing them together would be very greatly complicated.

The construction of a half-wave transmitter need hardly be touched upon since the arrangement will be just that necessary for d. c. operation. The modification of the transmitter illustrated for half-wave use would merely consist of the removal of one of the tubes, its associate plate condenser and its radio frequency choke.

The tuning of a self-rectified transmitter is a similar process to that of adjusting a d.c. supplied transmitter with the one important difference in the case of a full-wave set that the two tubes must be adjusted to generate the same frequencies. In this work the use of a monitor of some kind is absolutely indispensable. With the average "1928" type self-rectified transmitter the frequency "flutter" was so great that the frequencies of the two tubes overlapped even if they were five or ten kc. apart. With a High-C transmitter in which the usual care has been taken with grid excitation, and antenna tuning the two separate groups of frequencies generated by the two tubes will be distinguishable in the monitor right up to the point when adjustment of the filament clip return merges them into one.

Our personal opinion, resulting from several weeks of intensive dabbling into self-rectification in all its forms, is that in cases where the station is so located with respect to broadcast listeners that interference with them is not a consideration the self-rectified transmitter is an entirely practical proposition just so long as the amateur is willing to build it correctly and maintain it in a

(Continued on Page 88)

1. *QST*, August 1928, page 9.
2. *QST*, January 1928, page 32.

Coming!
Governors-President Relay

ONCE again we have an opportunity for a worthwhile relay in which *all* amateurs in the continental United States could and should take part. The inauguration of the President of the United States takes place on March 4, 1929. In 1921 and again in 1925 we amateurs secured a message from the governor of each state addressed to the new President. We successfully relayed those messages to Washington, D. C., delivering them to the President right after his inauguration. At a later date the routing of each message, and full details of the relay including the handling of "service" messages to Headquarters concerning difficulties in securing messages and getting them off on schedule were reported in *QST*. This year we want to "put it over" again—and have some good fun and practise in relaying at the same time. Every station on the air will be looking for the traffic which will be originated simultaneously in forty-eight states (we hope all 48) and those stations most alive to the situation will have a chance to handle a good share of the traffic.

The relay will take place on the *third* and *fourth* of March 1929, beginning at 5 pm, E.S.T. March third and continuing through to 5 pm, E.S.T. March fourth, after which all the messages that have been received will be delivered at the White House. Get your station in readiness—and mark the dates up where you can't forget.

Each Section Manager in whose territory there is a state capital is designating an amateur to approach and secure a message from his governor addressed to President Hoover for transmission on this occasion. We are depending on each operator so designated by his S.C.M. to do his level best to *get* a message and see it started on its way properly. The messages will be limited to fifty words where possible and of course will be in the nature of congratulatory messages following the inauguration.

By the time this notice appears arrangements will be practically completed by the Washington Radio Club for a *continuous* watch to be kept at several of its different member-stations, and on the different frequency bands simultaneously. Most of the effort will be spent in covering the 3500 and 7000 kc. bands thoroughly, at the Washington end, although suitable periods of 14,000-kc. work are also planned in the tentative line-up which is expected to include W3NR, W3HL, W3GT, W3BWT, W3BKW, W3AGW and W3CDQ. W1MK at Hartford will also assist in collecting traffic for Washington or seeing it on its way as quickly and efficiently as possible. The regular W1MK schedules for March 3 and 4 will be set aside in favor of "general" operation, to enable the scheduled stations as well as the Headquarters station to take a full part in the relay. The stations of the Washington Radio Club have handled Governor-to-President traffic before and can be depended on absolutely to take care of everything sent in their direction. We are informed that these stations will call CQ GPR DE W3—each time before combing the bands for traffic Washington-bound. All stations are invited and requested to participate. Western stations should relay their messages to mid-west and eastern stations for QSP to Washington.

President Hoover may know that amateurs can do these things—but we want to once again put over the usual good performance and bring to his attention the fact that amateur radio is still *100% there!*

Following the relay don't forget to send complete and exact copies of the messages *you* handled showing the time received, the time forwarded, and both (or all) stations with which the message was handled. If you have comments on the relay please make them on separate sheets—the copies of messages with notations are most important of all to tell the tale, though. We want speed in relaying these messages—but first of all we must have *accuracy*. Everyone is asked to check his timepiece so the messages will correctly tell their story. Of course break-in operation will facilitate the message-handling work. Use it if possible. In any case, send no faster than the other fellow can copy, and you will thereby cut down on the time of relaying the messages which would otherwise be taken up by repeats. What we want to be able to do is to make a file of the messages turned in as originating in each different state, showing consecutive handling of this message through different stations as one reads the file from top to bottom. That means that we shall need copies from everyone handling or copying a message. Some of the messages travelled over more than one route during our last relay of this kind, too—and we want to be able to tell the whole story in *QST*. Please mail your copies and report promptly on March fifth. Don't forget to be ready for the messages which will go on the air at 5 pm E.S.T. March third (the same as 2 pm, P.S.T.)!

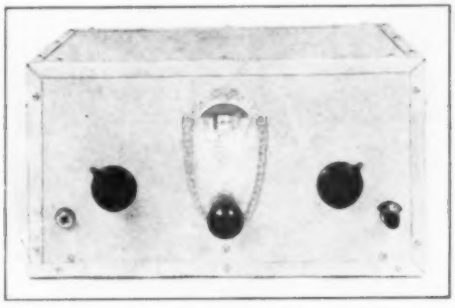
—*F.E.H.*

A "1929" Receiver

By Paul S. Hendricks*

THE FOLLOWING is a description of a receiver, built with some modifications on the general idea suggested by Mr. Hull's four-tube receiver described in *QST* for November, 1928. It may be of interest to those who would like to have a highly selective receiver for amateur work and still be able to listen to high frequency broadcasts and commercial stations which are found between the amateur bands.

The peaked audio amplifier provides excellent selectivity when a narrow band of frequencies is spread over the range of an ordinary vernier type tuning dial, but to cover the entire range from say 3,000 kc. to 15,000 kc. would require perhaps three dozen coils. It would then be suitable for c.w. signals only, as the peaked amplifier ruins broadcast quality Accordingly this receiver was provided with a switch to cut out the peaked audio stage and couple the output of the detector directly to the second audio stage, also cutting in a bias battery on the audio stage allowing it to give good quality. This gives a considerable drop in volume when changing from the tuned amplifier to the untuned amplifier but due to the large volume obtained with the tuned stage it is usually desirable to reduce the output by means of the volume control. Then, when switching from tuned to untuned, the volume control may be readjusted and the signal level will not differ greatly. The amplifier switch may be seen in two of the photographs mounted on top of the audio frequency transformer, between the two tubes at the left end of the set. The connections are shown in Fig. 1., the switch being marked "tuned" and "untuned."



THE COMPLETE RECEIVER

By complicating things a bit more another stage of audio might be added and the switching arranged to cut the extra stage in when the peaked stage is cut out, thus maintaining the volume level of the same order as with the peaked stage in and the volume control set at maximum.

The volume control R_6 is connected directly across the audio transformer secondary terminals and therefore may be used whether or not the peaked stage is cut in. It may be noted that the two-megohm resistor, R^3, which supplies bias to the last audio stage when the peaked stage is in use, becomes connected across the audio transformer secondary when the peaked stage is switched out. The effect is that of cutting down the amplitude slightly on the high end of the audio range. However, the effect will not be noticeable on good broadcast reception.

Another photo shows a front view of the receiver. The tuning dial in the center operates the condenser C, Fig 1. The knob at the left operates the volume control and the one at the right, the regeneration control. The output jack is at the lower left and the filament switch at the lower right.

The resistance for regeneration control, R5, instead of being in series as usual, is connected as a potentiometer. This arrangement is apparently no more critical than the usual method and the point of oscillation stays nearly in the same spot over the entire range for any one coil-condenser combination. The "B" battery drain due to the potentiometer arrangement is negligible, being less than one half mil with a 100,000-ohm potentiometer when using 45 volts on the detector. On this receiver the 45-volt tap for the detector works fine on all bands including the 28,000-kc. one. By connecting the "B" minus to the "A" minus lead outside the set, the potentiometer is automatically disconnected from the "B" battery when the filament switch is turned off.

The plate inductance L^3, for the peaked audio stage is, as used by Hull, a Ford secondary. A 0.01-μfd. condenser across it brought the tuned peak to about 1,000 cycles. The coil is fitted with a wooden core and mounted on the sub-base with a wood screw from the bottom. This may be seen in one photo between the cable connector plug and the screen-grid audio tube at the rear left corner of the set. The 0.01-μfd. fixed tuning condenser, C^3, may be seen, edgewise, in front of the Ford coil and the cable connector plug, and above the Amperite unit. It is fastened to the circuit

*A.R.R.L. Technical Development Program.

wiring by long screws on which additional condensers may be mounted if it is desired to lower the tuned audio peak.

The various tuning ranges are obtained by plug-in coil-condenser combination units. They may be seen in the photographs and the details of construction may be gathered. The coil forms are of the Pilot type which have five prongs that fit into a standard UY tube socket. Only four of the prongs are used. These coils have variously colored handles which had been removed to facilitate the connecting of the coil leads to the prongs. Unfortunately, they had not been replaced when the photos were taken. The tuning condensers are of the Pilot midget variable type which are available in a number of sizes of from five to twenty-three plates. For a given tuning range a condenser of approximately the right size was selected and then plates removed, when necessary, to obtain just the right amount of dial spread. One of the assembly screws forming the rotor mounting was removed and replaced by a General Radio plug. This fits into a G. R. jack and makes the ground connection to the low potential side of the circuit.

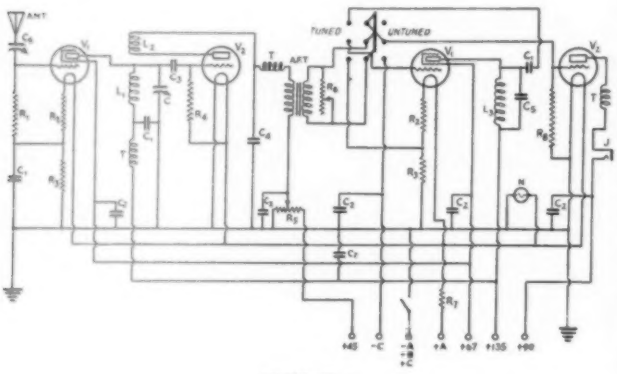
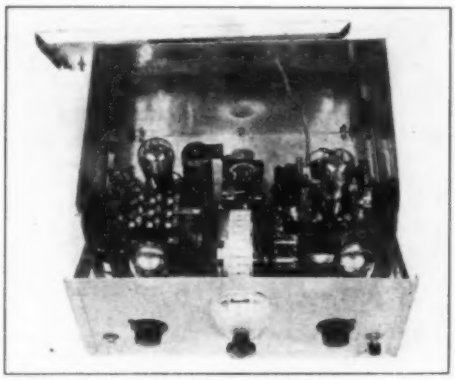


FIGURE 1

R1—50,000 ohms. "Grid-leak type resistor" or r.f.c. (See text).
R2—10 ohms. Fixed resistor.
R3—5 ohms. Fixed resistor.
R4—8 meghoms.
R5—100,000 ohm Frost variable resistor.
R6—200,000 ohm Frost variable resistor.
R7—¾-amp. Amperite.
R8—2 meghoms.
C—Pilot Midget variable condensers (see photos and text).
C1—0.006 µfd. Sangamo fixed condenser.
C2—1.0 µfd. Sangamo by-pass condensers.
C3—0.0001 µfd. Sangamo fixed condenser.
C4—0.001 µfd. Sangamo fixed condenser.
C5—0.01 µfd. Aerovox fixed condenser.
C6—0.00005 µfd. (50µµfd.) Pilot midget variable condenser.
L1—Plug-in inductances (see text).
L2—Tickler.
L3—Secondary of Ford spark coil.
T—R.f. chokes. Silver-Marshall, type No. 275.
AFT—Audio frequency transformer, Sangamo high quality type.
V1—CX-322.
V2—CX-301-A.
N—Dial lamp, as furnished on National drum dial.
J—Output Jack, single open circuit type.
G—To ground and metal cabinet.

The coil-condenser assembly is really quite simple. The two units are joined by a pair of ⅜" brass strips which are drilled at each end to pass 6-32 brass machine screws. One end goes under the thumb nut on the condenser. The other end is bent at a right angle and screwed to the side of the coil form, with short 6-32 screws, for which the form had been drilled and tapped. These strips are attached to the grid side of the tuning condenser and the grid end of the tuning coil is soldered to one of them. The grid end of the coil also connects to the grid pin of the coil form permitting the connections to the r. f. tube plate and the detector grid to be made on the corresponding terminal of the UY socket. The secondaries are all wound with No. 20 enameled wire and the ticklers with No. 24 d.s.c. wire. The 3,500-kc. band coil has no spacing between turns and the rest of the coils have their turns spaced from one to three times the diameter of the wire. The adjustment, especially for the 7,000-kc. and 14,000-kc. bands, is quite critical. The method used in adjusting this set of coils was to wind them with a spacing of between one and two times the diameter of the wire and then remove turns until the coils were somewhere near the right size. The final adjustment was made by pushing the turns closer to each other or farther apart until the range was just right. The coils were then doped with collodion or DuPont Household Cement, spread along several of the ribs on the coil form. It does not take much dope, even when only a narrow strip is put along three or four ribs, to throw the calibration off and it may therefore be necessary to make a slight readjustment of the end turn after the dope has dried. The tickler is placed near the open end of the coil form which is near the filament or low potential end of the tuning inductance. The ticklers, except on the 28-mc. band, are close wound and stuck at four points with dope. The tickler for 28 mc. is spaced about twice the diameter of the wire. It was found convenient to make the final adjustment for the 28-mc. band by sliding the tickler turns about slightly. With the tickler turns wound

closely to each other it was found impossible to tune to a frequency higher than about 27 mc. By spacing the tickler turns it was readily possible to adjust the combination to reach 33 mc.



WITH LID OPEN

The manner in which the coil-condenser combination plugs-in is not clearly shown in the photographs. It consists simply of a pair of ½" by 1/16" brass brackets fastened to the metal sub-base, thus supporting the UY socket and a G.R. jack in such a position as to accommodate the coil-condenser combination as a unit. The coil plugs into the UY socket and is held in a horizontal position. The condenser stator is connected to the coil through one of the brass brackets holding the two together while the other side of the condenser makes connection to the rest of the circuit through a G.R. plug which slips into the jack mentioned above. The shaft of the condenser plugs into the hollow dial shaft and is fastened by means of the set screw.

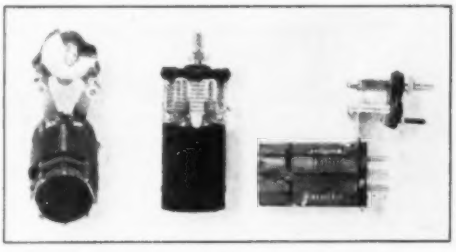
In order to have the dial read in terms of frequency instead of wavelength it was necessary to set the dial at zero with the condensers at maximum capacity. The calibration is then held by always plugging in a combination under these conditions. A brass wing was stuck into the slot in the head of the set-screw on the dial shaft and soldered securely so that it is unnecessary to use a screw driver to tighten and loosen the condenser shaft when changing units. For convenience the set screw was moved half way around the shaft.

Incidentally, the dial lamp furnished with the National drum dials makes it easy to watch the scale and serves also as a telltale so that one is not so likely to leave the set turned on and find a dead "A" battery, some time later when a dash is made into the station to keep that next sked.

The small variable antenna coupling condenser, C^v, with its knob may be seen in one photo behind the plug-in unit and to the left of the r. f. amplifier tube. One corner of one of the stator plates is bent so that it touches one of the rotor plates when the condenser is turned to the maximum position thus forming a switch which short circuits the condenser and leaves the antenna connected directly to the receiver. For a given antenna and tuning range, the condenser, C^v, may be set and it is, therefore, not necessary to have its control on the panel. It is mounted well above the base, on an insulator which was originally the shell of an Aero r. f. choke. It has nearly the same dimensions of an ordinary tube base. A tube base would serve just as well if its prongs were removed. The condenser is fastened to the closed end and the shell is bolted to the base with two angle brackets.

The input to the r. f. tube is supplied with energy from the antenna by being connected across the resistor R^1 which may be seen in the right rear corner alongside the r. f. tube. One of the little Silver-Marshall chokes, type No. 275, was fitted with a pair of "ears" taken from an old grid leak and soldered to its terminals thus making it possible to plug in the choke instead of the resistor R^1. That makes it a simple matter to change the input coupling from straight resistance to inductive impedance which usually gives better signal strength at the lower frequencies.

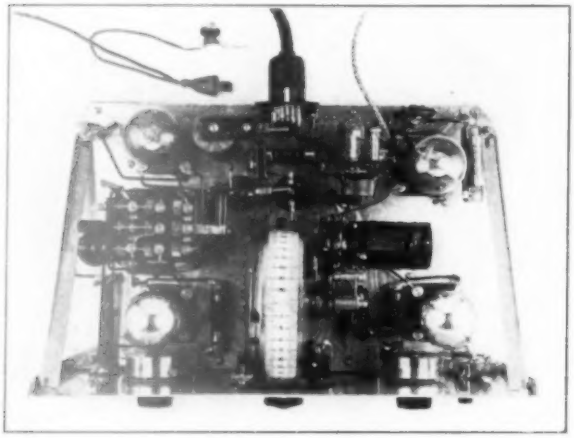
The use of r. f. chokes and by-pass condensers, wherever necessary, has made this receiver very smooth in operation with no dead spots and no tendency to howl at any point over its entire tuning range. The connections of the by-pass condensers are



HOW THE COILS AND CONDENSERS WERE HOOKED TOGETHER

shown in Fig. 1. They do not show in the photographs as they are mounted on the under side of the metal sub-base. Their location is such that their terminals are directly beneath the points to which they connect above the sub-base. They are fastened to the sub-base in each case by two 6-32 machine screws and nuts, one of the

screws being attached to one of the condenser terminals and forming the ground connection. All of the battery wiring goes directly from the cable connector plug through a hole to the under side of the sub-base. The wires are then brought through holes in the sub-base to the proper terminals on the various pieces of apparatus. In order to insure against bad insulation where the wires come through the sub-base, the wire used is a light grade of high tension wire, such as is used in automobile wiring. It has rubber insulation over which is woven a very tough varnished fabric covering and it may be obtained in a variety of sizes at most auto supply stores. As can be seen in the photos there is very little wiring above the sub-base, there being only the wires connecting the high potential sides of the circuit. The apparatus is so arranged that leads are all short and direct.



LOOKING INSIDE THE SET

The r. f. chokes in the plate circuits of the r. f. amplifier and detector may be seen mounted just behind the drum dial on the base. The choke in the plate circuit of the output tube can be seen behind the output jack and to the left of the switch which cuts out the peaked stage. The two tubes near the front of the set are; on the left the audio output tube and on the right the detector. Their respective grid-leaks may be seen mounted near the socket of each.

The all-metal shielding cabinet is not at all difficult to construct. The whole thing including sub-base and corner angles is made from 1/16" aluminum sheet which may be obtained in most tinsmith shops and is carried by some hardware stores. The tinsmith's shop usually has a machine which will cut the sheet accurately to size without bending or distorting it. The corner angles were made by cutting one-inch strips and bending them at right-angles in the middle, with a tool designed for this purpose. The assembly of the cabinet which is bolted together with 6-32 machine screws and nuts may readily be understood from the photos. To settle the argument as to how the corner angles were to meet, both ends of every piece have their corners clipped off at a forty-five degree angle. As may be seen, they all meet in the same manner and make quite a neat job of it. The sub-base is bolted to the panel with a piece of the same angle stock as was used in putting together the cabinet. Two more pieces running between points near the top of the front panel and the rear of the sub-base act as braces. Another piece across the rear makes the whole assembly a rigid affair mechanically and provides a firm support for the cable connector plug. The outside surface of the cabinet and corner angles was given a pleasing finish by "sandblasting" with a machine which is used in foundries for cleaning certain castings. The inside dimensions of the cabinet are: 7½" high, 14" long and 9" deep. The sub-base is fastened to the front panel so that there is a space of 1½" between it and the bottom of the cabinet, thus providing ample room for the six by-pass condensers and the battery wiring. The volume control and regeneration control, which are mounted on the front panel, have a metal body to which the variable contact is connected. It was therefore necessary to insulate them from the panel which was done by making washers from a piece of 1/16" Bakelite. Ordinary sheet fibre or sheets of mica from a blown condenser may also be used.

All of the apparatus plus the front panel and sub-base can be slid from the cabinet by removing one bolt on each side of the cabinet and two screws from the bottom. On each inner side of the cabinet near the bottom may be seen two more pieces of the angle stock bolted in place to form skids for removing the assembly and to act as supports for the sub-base when the set is in position in the cabinet.

The seven battery connections are made with a Yaxley cable and connector plug which has just seven wires. The connector plug works very smoothly and apparently makes good dependable electrical connections. Since it is such a simple operation it is advisable to remove the plug whenever changing plug-in units or making

(Continued on Page 86)

Let's Get Serious

By Joe Gish

JANUARY 1, 1929, the magical date, came upon me yesterday. It caught me in the act of snooping around the amateur bands with a receiver in one hand and a transmitting lever in the other. There was much more of a change in the weather from 1928 to 1929 than there was in operation within the amateur bands.

"What are the limits of the bands?", "What does QSA3 mean?" Can you imagine that? Those quotations are genuine. Heard them myself. When questioned, the author of them admitted he had missed several *QSTs*. Heavens, tell me what *QSTs* he wants and I'll buy them and send them to him! If he is going to wander along in the coming year just picking up everything that is considered recent amateur practice from some ham who is doing what is right, there is going to be some punk operating from *that* station.

Do you know the new "Q" signals to be used from now on? Good. Seems as though darned few of the boys did. One fellow was overheard saying that he must QRT as he was QRW helping the OW. Taken literally that would mean that said ham had to stop sending because he was calling his OW. What? Doesn't sound logical but maybe this man knew what he was doing after all. Maybe he was calling her but he wasn't saying *what* he was calling her! Better get off that subject before we get in hot water.

Along about noon I was working some ham and ranting along about a new rectifier and I broke and gave him the GA. He came back with, "QRM QTA". Not to be outdone I shot back, "Whatdaya mean cancel radiogram, I was telling you something". And then what did he come back with but, "What are the new Q signals guess was my mistake." Can you imagine *that?* He expected I was going to spend the rest of the day sending the list of "Q" signals to him. Guess he wouldn't mind if two or three pages were taken up in *QST* every month to a repetition of the "Q" signals. This reading *QST* by looking at "Calls Heard", skimming over the rest of the book with a look of torture over your face is the bunk. Be observing and notice what is new and set forth every month.

Seriously now, let's get good and serious. This isn't just a kid's game. A fellow out in Oshgosh who never heard of short waves can't by a series of eliminations to a receiving set make a transmitter that will enable him to work the Antipodes. That is a thing of the past. Nowadays a person must be attentive to all the developments going on in the gentle art and make use of them. Let's all of us be operators. That doesn't mean knowing the code from A to Z with no stumbling blocks but to be up on all recommended amateur practices. That word operators covers about everything too, as a good operator is one who can tune a transmitter and get the best results from the equipment at hand. Each and every one of us should be an operator and take pride in knowing that we are. This game holds forth much more for us in the future than it has in the past few years. Four years ago DX was the fad. Then, to the fellows who had been the first to accomplish this, the old note faded and what could they do? Now that is all at an end. There is more to work for. One can be improving constantly on his transmitter, receiver and aerial system, besides helping in the development of new frequencies. And right in that is there a huge assignment. In the past the receiver and transmitter were components in the word DX which were only given attention when they failed to give forth blasts or the antenna meter failed to wrap itself around the pin.

Let's take stock of everything that is good practice for an operator in the coming year and see for ourselves there is much more pleasure in the game now than in the past.

Silent Keys

It is with deep regret that we record the passing of these amateurs:

Ashley Dixon Jr., Portland, Ore., 7IT.
Richard B. Chase, West Baldwin, Me., ex1KX, and Cragmor, Col., 9FUY.
Moses Bradford, Concord, Mass., 1IU.
George R. Gerig, Portland, Ore., 7WU.
Harold Hayes, Canajoharie, N. Y., ex8BGY.
Joseph A. Steinlage, St. Louis, Mo., 9CGN.
H. K. Nelson, South Bend, Ind., 9FLU.
Eric Colpus, Pontiac, Mich., 8CYT.
William Richardson, Oakland, Cal., 6AJA.
Edward E. Falkenback, Long Island City, N. Y., 2AKY.
Richard Ballentine, Millvale. Pa., 8CXH.
Joseph De Worth, Jersey City, N. J.
C. J. McDonald, Dresser Junction, Minn., W9GEY.
Raymond W. Mahoney, Bangor, Me., W1AVQ.
F. A. Pepper, Los Angeles, Calif., W6DMT.

A Cheap Radio Frequency Meter

By George W. Woster*

THERE are many who are employing receiving tubes for low power transmission and don't feel that they should spend as much for a radio frequency ammeter to measure the antenna current as they have spent for the entire transmitter itself but who would, nevertheless, like to have some idea as to how much current is flowing in the antenna circuit. A simple arrangement may be arrived at which will allow quite small amounts of radio frequency current to be measured and is shown in Figure 1.

The general idea is to insert a small flashlight bulb in the antenna circuit and adjust the amount of current flowing through it from the battery by means of the rheostat provided for the purpose until the filament just shows color. Either the current through it or the position of the rheostat dial (assuming the rheostat to be calibrated before-

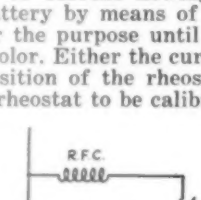


FIGURE 1

hand) is noted and the transmitter put in operation. The bulb will then grow brighter because of the additional amount of current flowing through the bulb. When the proper adjustment of the transmitter is obtained, the resistance in the lamp circuit is readjusted so that once more the filament just shows color and the difference between this reading and the previous one is the amount of radio frequency current flowing through the lamp.

It is, of course, necessary to use chokes to prevent the radio frequency current from by-passing around the lamp through the battery and rheostat circuit. Two r. f. chokes are provided and consist of 200 turns of No. 28 d.c.c. wire on a bakelite tube ¾ inch in diameter and five inches long. The complete outfit consisting of the chokes, a porcelain miniature receptacle, a Mazda No. 14., 2.5-volt spotlight bulb, a single flashlight cell and a 10-ohm rheostat may be assembled on a 3" by 3" panel in a small box.

With the specified bulb, the meter will measure r.f. currents up to 0.1 ampere and for currents between 0.1 and 0.2 amperes, one may use a Mazda No. 19, 1.25-volt bulb. The lamp alone will light up on currents larger than this and the rheostat cannot be used. The instrument is not particularly suitable for these higher ranges unless a lamp requiring a high current is used which will be a larger drain on the single cell, the voltage of which will vary considerably and the life of which will, therefore, be short.

The most satisfactory arrangement is to insert a low resistance milliammeter of 0-200 mil range in the battery circuit and find the difference between the two readings. However, for very approximate work, it is possible to roughly calibrate the rheostat dial to read in milliamperes through the lamp.

The resistance of the choke coils will be 2.8 ohms each and that of the bulb when the filament is showing a barely visible red coloring is approximately 2.5 ohms. The total resistance not including the rheostat is, therefore, 8.1 ohms. With no resistance of the rheostat in the circuit, the current will be 185 mils and with all the resistance of the rheostat in, it will be approximately 80 mils. At the quarter, half and three quarter points on the rheostat, the currents will be 95, 115 and 140 milliamperes approximately. This assumes that the voltage of the cell remains at 1.5. In practice, unless a large cell is employed, this voltage will vary under the loads resulting and the readings can only be considered as being approximate. The above current values are obtained with the No. 14, 2.5-volt lamp.



AN OLD TIME DRINK THAT'S BOUND TO REGAIN ITS POPULARITY AS A TONIC

*W9FKH, Reliance, S. D.

The Design of Inductance Coils

By D. R. Clemons*

In these days of reception and transmission at extremely high frequencies, one is apt to overlook many factors underlying the proper design of inductance coils purely because the normal inductance consists of such a small amount of material. A reading of this article should bring to mind many points of design that deserve the most careful consideration. Its general treatment of the subject will probably clear up many false impressions that seem to be prevalent among amateurs.—Editor.

THE UNIT of inductance is the henry. This unit was defined by the Chicago Congress in 1893 as the inductance "in a circuit when the electromotive force induced in this circuit is one international volt while the inducing current varies at the rate of one ampere per second."

James Clerk Maxwell seems to have been the first to treat self-inductance mathematically and prepared formulas for various coil shapes then in use. Gauss, probably working with Weber, seems to have calculated a number of cases of induction, but it is not generally known for what purpose this was done. Maxwell's calculations involve the mutual effects of parallel conductors, and in giving formulas for the various coil shapes, he also prepared corrections for wires of various cross sections and insulation thickness. Maxwell showed that unequal distribution of magnetic flux through the windings would reduce the self inductance of a long coil as shown in Fig. 1, where the solenoid, spiral, and multilayer coil, although of equal wire lengths, have different values of inductance due to the mutual effects of turns being different. The solenoid having a flux distribution along a cylinder of considerable length must act through greater distances than for the compact coil C in which the flux is restricted to a very small volume of space in comparison, and the mutual effects are consequently much greater. As we shall observe later on, the spiral for windings not too deep takes characteristics of the solenoid both in its electro static and magnetic values, and for great spiral depths, has characteristics mid-way between the solenoid and compact type of winding. Formulas for calculations of self inductance are available in many standard publications. Such formulas are necessary in designing radio circuits. Tables of corrections for wire sizes and insulation thickness are also available. It is possible to calculate the greatest inductance for a given form or spool wound with various wires; best shape for a coil of given inductances; best shape providing a maximum inductance for a given length of wire and so on. Let us examine the formula and factors governing the inductance of the solenoid:

$$L = \frac{0.03948 \times A^2 \times N^2}{b} = K \text{ microhenrys (1)}$$

The value 4π appears in formulas for inductance and refers the coil's area back to the spherical surface of the unit magnetic pole. The "unit pole" was considered as that strength which, when placed at the exact center of a sphere of 1 cm. radius, would produce one assumed line of force in each square centimeter of spherical surface. We find that a sphere of 1 cm. radius has $4\pi r^2$, or 12.57 square centimeters surface area, hence 12.57 or 4π lines must originate at the sphere center to bring about this

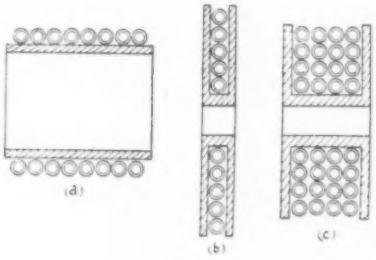


FIG 1

condition. The above formula is in practical units by which inductance is expressed in microhenrys, therefore to carry the current sheet back to spherical measure involves $\frac{4\pi^2}{1,000}$ hence the constant 0.03948 reducing from dimensions to practical units.

The inductance of a solenoid varies in direct proportion to its dimensions when the number of turns remains the same; hence we find that making both the winding length and diameter twice greater will double the inductance. In coil designing, consideration of this is very important since it is often required to use very large or small wire, or provision may require greater separation between turns for coils subject to higher currents and voltages.

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Where very heavy cable may be necessary to carry several hundred amperes of high frequency current, the winding pitch, for insulation purposes, may be very great, and while such coils are several feet in diameter and possibly ten feet long, their inductance is of a value that may also be obtained on a tube only 1.5 inches diameter and 1 inch long, the wire for the small coil being of course, very fine. The smaller coil will be capable of handling small currents only. Thus a coil of given inductance may be of very large or small dimensions according to the physical and electrical requirements involved.

DISTRIBUTED CAPACITY

When a current of any magnitude moves through an inductance coil there is associated with it magnetic and electric fields which act together through the medium surrounding and containing the current sheet. If only one of these fields exists at a given instant there can be no current or flow of energy. Along the current axis of the entire winding there is an infinite series of potential points established as a result of the self inductance of the coil, which points are electrically related as a potential difference to all other points or group of points comprising the series. These points having position on the wire, are separated by a dielectric medium in which displaced currents may act, and cause transient currents in the medium each time any change of current magnitude takes place in the coil. Such displacement, due to the potential of self induction generated by the current stream acting through the conductor space occupied by the coil, permits energy to be stored in the dielectric. Any increase or decrease of potential brought about by the counter voltage of self inductance causes energy to be stored in the dielectric or returned to the circuit. Such dielectric action is always present and associated with every coil having reactance, the quantity of energy stored being largely governed by the geometrical distribution of potential (coil shape and type of winding) and the inductive capacity of the medium in which the action takes place. Since energy is so stored in the dielectric during transient periods, the coil has capacitance, and since this is obviously due to a distribution of potential, it is called distributed capacity.

Distributed capacity may be defined as that quantity which will satisfy the value C_o in the familiar Thomson equation for frequency which we will write

$$\frac{1}{W^2} = L\ (C \times C_o) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

or in terms of wavelength

$$\lambda_m = 1884 \sqrt{L\ (C \times C_o)} \ldots\ldots (3)$$

For Formula (3) the units are in microhenrys and microfarads. The distributed capacity of a coil may be very small or an enormous value depending on the design and arrangement of the windings. It is the writer's intention to point out the importance of the constant, C_o, and to show its effect on the operative frequency of circuits; also to explain such details that may be helpful in determining its value.

In measuring the inductance of radio coils at high frequencies, it is customary to use a known value of capacity in shunt to the coil and measure the frequency of the circuit. A value for inductance is then obtained by a simple formula giving the apparent inductance of the coil which value is invariably too large, the error from the real inductance being dependent on the value of known capacity used and the frequency. When roughly obtained in this simple manner, the value for the coil is called the apparent inductance. We have used a known value for the capacity C; no estimation of the distributed capacity was made, consequently the apparent value is too large since the capacity C_o was equivalently in parallel with the condenser C as shown at A in Fig. 2. Suppose a common honeycomb coil of 100 turns is measured by this method using a condenser of 500 μμfd. known capacity; the wavemeter measures 1031 meters, so we obtain from the known values 599.3 μhys. inductance which is the *apparent* value. The correct value of distributed capacity is 22.9 μμfd. for this one coil, hence the total capacity is $C \times C_o$ or 522.9 μμfd., which gives 573.0 μhy. *pure inductance*. Here we find the error to have been over 4 percent for this normal illustration. Since this error may be involved in squares, it may be sufficient to create an enormous error in more complex frequency calculations. If the condenser capacity C is smaller or is small in comparison to the coil capacity, or should the coil capacity be very large—as it is for many types of coils—errors of 10 percent or more may develop. Hence, in all precision work, the distributed capacity should first be determined if the pure self inductance of the radio coil is to be known. For entry into precise formula, the constant C_o and the pure inductance should be employed.

In designing frequency meters, coils calculated without consideration of the distributed capacity may not provide overlaps of frequency bands for the several coils used, therefore, it is common practice to employ the "trial and error" method, or to make estimations by considering but 30 to 80 percent of the condenser capacity available. By careful estimation of the distributed capacity of the coil it is possible to obtain precise overlapping of frequency

ranges. Owing to the coil capacity in any frequency meter, methods of interpolating in a calibration may cause considerable errors which increase as the capacity of the tuning condenser decreases. It is better to calculate certain values of frequency using the obscure constant C_o than to depend on interpolation. Many excellent articles appearing from time to time on the mathematical design of coils for frequency meters and receivers have passed as negligible or entirely neglected any corrections for the coil capacity, although in many cases designs may consider coils of inherently large capacity. While it is true that the capacity is quite low for the spiral and solenoid suspended in *free space*, and is negligible providing the tuning condenser is *very* large, coils are never so used in free space. This is illustrated in modern broadcast receivers. Where one terminal is grounded to other apparatus, or where the coil is electrically related to a magnetic or electrostatic shield, the effective coil capacity becomes very large, sometimes increasing several hundred percent above the value C_o for the free coil, and demands attention if correct calculations or final operation of the set, are to apply successfully. Errors in the expected frequency bands are large for moderate sized coils using condensers of less than 500 μμfd. and such errors become very large at higher frequencies approaching the coil fundamental, near which frequency terminal currents of the coil become nearly zero, causing very broad or impossible tuning on the highest frequencies of each band. This effect is due to a condition of parallel resonance, which occurs at or near the fundamental frequency as determined by the pure self inductance and distributed capacity of the coil. Where the apparent resistance of a coil is measured we find the coil resistance increasing rapidly as the coil fundamental is approached. By designing coils for a minimum of distributed capacity the effect may be greatly reduced; but until one has sound understanding of the factors governing magnitudes of capacity it becomes difficult to design coils of small capacities, for aside from simple theory and geometrical consideration, coil capacity may be considerably affected, by conditions external to the coil.

The features which give to a coil a high or low distributed capacity are not generally understood, and unless direct experimental work is done on many coils of various types of winding, it is difficult to approximate coil capacity. While determination of the magnetic flux density acting in the dielectric is purely a mathematical problem, exact calculations or even approximations of the electrostatic component are especially difficult due to the complex nature of the dielectric medium and the uncertainty of the manner in which the potential is distributed along the coil winding. The potential node may shift position in a mounted coil. There seems to be no generalized formula for the calculation of coil capacity. Probably the most conclusive mathematical analysis has been reported by G. Breit who gave mathematical processes and formulas for calculations of coil capacity of cylindrical windings. In general, the report deals with coils ungrounded and in free space;

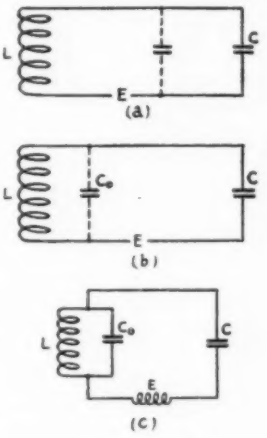


FIG. 2

coils with one terminal grounded, and coils within elliptical shields or before flat plates. For a cylindrical coil in free space unshielded and with coil center grounded, Breit gives the formula

$C_o = 0.06952\ K\ L$ μμfd. . . . . (4)

where L is the perimeter of the coil and K the inductive constant of the medium subject to the electric flux. This is for coils of cylindrical windings and shows fair agreement with values experimentally obtained when applied to very short air insulated coils. It may be satisfactorily applied to solenoids of short length, C_o being approximately equal to 0.44 x r μμfd., where r is the coil radius in centimeters. To illustrate: An 11-turn, single-layer coil 8.2 cm. in diameter and 17 cm. long gave a measured capacity of 1.750 μμfd. and a calculated value of 1.792; a 36-turn, single-layer coil, 12.6 cm. in diameter and 3 cm. long gave 2.457 and 2.751 μμfd. respectively for the measured and calculated values. For a coil of very large diameter, while actually measuring 8.064 μμfds. calculations gave a lower value of 5.76 μμfd. The above formula (4) may also be applied to spirals of small winding depth.

The distributed capacity is too small when calculated from the coil geometry alone is too small, the error becoming larger as the winding length increases. Moreover, by examination of the formula (4) we find the constant K of the medium through which the electric flux acts: As dielectrics in the region of greatest flux density are usually compounded and of divergent nature, it is quite impossible to give to any common coil a correct value for the term K. For a short coil of bare wire in free space, the formula is very accurate and yields well; or where the coil, having a bare exposed winding, is entirely submerged in

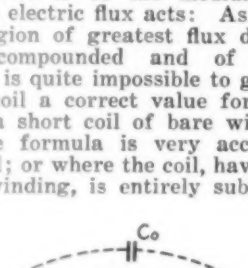


FIG. 3

a dielectric of known inductivity in such manner as to completely enclose the electric flux in this new medium, the coil capacity will then be found to vary as the constant K of the new medium; but for coils in which the entire dielectric subject to the electric displacement is of a compound nature and of arbitrary position, it is quite impossible to accurately estimate the value for the constant K. Such dielectrics as cotton, silk, enamel, and other insulating materials; tubes for coil mountings and compounds of laminated bakelised paper; insulating varnishes and oil, all have variable constants of about 2.00, but this value cannot be used and satisfy K. An increase of capacity due to adjacent dielectrics cannot be calculated directly unless this material occupies the entire electric field of the coil, and obviously, in spirals and about cylindrical windings, the added material may occupy only a small portion of space through which the field acts. There is no direct or satisfactory mathematical method of calculating the final capacity of mounted coils subject to the several effects which may act increase the value of distributed capacity.

RESISTANCE

The four circuit parameters which we must consider are; resistance, inductance, capacity and leakance. These combine to make up the effective resistance. The effective resistance of a coil at radio frequencies depends largely upon the frequency and upon the position of the coil in the circuit, particularly on the point at which the voltage is impressed on the oscillatory system containing the coil under observation. If an inductance coil is freely suspended in space the frequency at which the currents will have maximum amplitude in it is determined by the self inductance and distributed capacity of to the coil or

$$f = \frac{1}{2\pi \sqrt{L\,C_o}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where L and C_o are in henrys and farads respectively. The variation of high frequency resistance of the copper is according to the frequency. Due to the coil resistance and to some radiation from the coil, there will be a very slight variation in resonant frequency from that obtained by formula (5), but since both radiation and coil resistance effects are almost negligible in affecting a circuit's frequency at radio frequencies, the frequency of oscillation is very closely obtainable by formula.

If an inductance coil is connected to a condenser as shown in Fig. 2A, the apparent coil resistance will depend largely upon the frequency and the manner in which the potential acts on the coil. If the potential is induced into, and acts directly in the coil L as at E, the coil capacity C_o acts in parallel with the condenser C, and at all lower frequencies to which the coil may then be tuned, resistance is due mostly to the conductive properties of the copper winding, but as the resonant frequency increases with the reduction of the condenser capacity C, the coil fundamental is approached at which frequency the effective resistance becomes very high for all small values of the condenser C. As this limiting frequency is approached, the coil terminal circulating current becomes nearly zero although it is large, near the coil center; but for all lower frequencies not too close to the fundamental, currents become more uniform through the coil. To be exact the frequency of such a circuit must include the obscure coil capacity C_o and is equal to

$$f = \frac{159{,}200}{\sqrt{L\,(C + C_o)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where the units are expressed in microhenrys and microfarads.

Where an inductance coil is located in such position that the potential is impressed upon its terminal as shown at B in Fig. 2, the coil capacity acts in shunt with the inductance independently from the condenser C and establishes the effect of parallel resonance as illustrated in 2C. In this case the combination L and C_o becomes resonant near the coil fundamental with the

potential acting at E, and the effective circuit resistance to circulating currents becomes enormous with nearly impossible tuning at or near all higher frequencies. These effects are often found in circuits provided with loading inductances or coils provided with taps. A potential applied at E encounters the self inductance of the coil L, raising the potential along the coil, permitting displaced currents to act in the dielectric of the coil capacity C_o; which capacitance energy is subsequently returned to the circuit with negligible loss. At or near the resonant frequency of the coil, these local circular currents in L and C_o reach a value often quite equal to currents through the condenser C and coil E. If a parallel circuit of zero resistance were in this position, the counter voltage of self inductance would increase with the local coil current until it became exactly equal and opposite to the impressed voltage in E, and the impedance of the coil L with C_o would be infinite with respect to the external circuit containing C, while the terminal current then being zero would permit no current whatever to pass through the coil L from the condenser C. But the imperfect conducting material in the winding, together with an imperfect dielectric about the coil with some slight radiation from the coil causes a loss of power which may be assumed constant with a given frequency, hence the only current that may pass the coil L at the resonant frequency is that current required to maintain the power loss due to coil resistance. At radio frequencies, the copper resistance of a coil

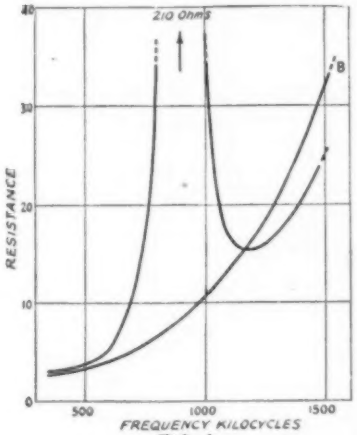


FIG. 4

may be large, and at the fundamental frequency of the coil L, some current will pass to maintain the loss, but due to the parallel resonance effects, the effective resistance to terminal currents at resonance of the coil will be enormous. Actually, with zero resistance, neglecting transient periods of very short duration required to establish currents in L and C_o, no current whatever would pass the coil terminals. This is the theory of the wavetrap: The trap inserted

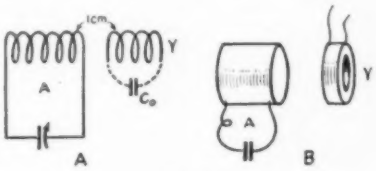


FIG. 5

in the antenna circuit is tuned to resonance with the station to be eliminated; the effects mentioned take place and choke out the undesired frequency. Obviously, then, to be efficient and completely stop this one frequency, the trap should have the lowest possible copper resistance, requiring special stranded cables known as Litz; a very good condenser; perfect insulation, and no high resistance metal in the coil field would be requisite for this condition. Such a circuit would tune very sharply and would stop but a very narrow band of frequencies while all others would pass the trap.

If parallel resonance effects are present in receiving sets there will be frequencies near which band sharp tuning is practically impossible and signal frequencies become weak. To cover a large frequency band a large coil may be wound and provided with taps at various positions as shown in Fig. 3 in which a small portion of the coil used with the condenser C forms a tuned circuit at A. Now, this coil is quite large and has inherent capacity which gives to the coil a fundamental frequency in free space, and this frequency becomes lower by the addition of several taps and by grounding the coil end to extra apparatus forming the circuit A. Let us suppose the entire coil, when wired as shown, to be resonant at 750 kc., and that the coil is inductively coupled with the antenna and has a potential induced in it near the section A. For various impressed frequencies we may adjust the condenser C and develop considerable signal currents in the circuit A, but on tuning through and very near to 750 kc., the entire coil becomes resonant, establishing a complex parallel effect in the circuit A making sharp tuning utterly impossible and signals quite inaudible near the fundamental frequency; but the system again becomes tunable in the circuit A at all lower frequencies. Near the fundamental, terminal currents in the circuit A become nearly zero because the current anti-node of the in-

ductance coil has shifted beyond the circuit A, hence the terminals of the tuned circuit A do not enclose a potential which had been produced at all other frequencies. In this manner a parallel resonance effect at or near the fundamental frequency make the set not only untunable but also very sensitive to any static changes taking place in the entire coil field. Such undesirable effects are equivalent to a loss of energy as the effect tends to reduce the usual energy acting in the circuit A, so by expressing the entire phenomenon as resistance we have a method of showing current magnitudes at various frequencies.

Two solenoids were made up to demonstrate this effect: The circuit A of Fig. 3 was to be measured at various frequencies

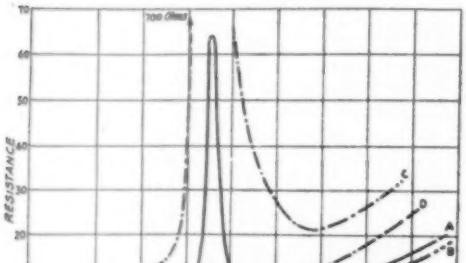


FIG 6

by the resistance variation method. The potential is induced in the section A by coupling to a 10-watt oscillator. This coil, illustrated as B in photo A, has 144.0 μhy. inductance included in the circuit A and measured as follows: As the frequency approaches the coil fundamental, the resistance in circuit A increases gradually to 5 ohms at 600 kc. Then on approaching 900 kc., due to parallel effects described, the resistance suddenly increases to 210.0 ohms, again falling to 15.5 ohms at 1,200 kc. and thereafter increasing in a normal way with the frequency as shown in Fig. 4. At any frequency near 900 kc., the critical effect of the capacity C_o was so pronounced that anybody moving within several feet of the coil was sufficient to detune critical adjustments—which adjustments were made by insulated rods several feet long. This is described to show the extent to which the electrical component may be altered by objects even remotely related to the coil. Such variations of capacity are considerable in very long solenoids due to various modes in which currents may be distributed.

Obviously, if the coil capacity should be removed, parallel resonance effects would be destroyed. This can be brought about by shorting the unused part of the coil. It might seem to the reader that shorting the unused part of the coil greatly reduces the self inductance and increases the resistance of the inductance included in the circuit A, but this change is almost negligible, particularly if the unused portion of the coil is large. In this instance, the impedance in the shorted portion is between ten to thirty thousand ohms for the frequencies used in this experiment, hence, negligible currents cause but insignificant loss in the shorted part of the winding and have but little reaction on the oscillatory circuit. In the second curve B of Fig. 4, we have the effective resistance of the system A with the unused turns shorted by a heavy wire. The resonant condition is completely destroyed and little change of resistance is observed over the useful band of frequencies covered by circuit A. The slightly greater increase at very high frequencies is due mostly to stray capacity of the shorted part which tends to increase the capacity of the system.

There may be a second inductance coil at some distance from, but inductively related to, the coil in which useful oscillating currents are generated, and if this isolated coil has a free period, it may react and seriously affect the operation of the coil in use. Such a coil might be a loading coil havng a position as shown in Fig. 5A, and at B. This coil at Y becomes energised at its fundamental, reacting mutually on the tuned circuit A, increasing the latter resistance acccording to the inductive relation between them. To demonstrate these effects a coil was tuned with a variable condenser forming the useful circuit A in Fig. 5a. The coil at Y was a Litz-wound coil of square cross section, and with the terminals open the resistance of circuit A was measured and is shown as Curve C in Fig. 6, for which the coil windings were separated 1 centimeter apart, giving above 700 ohms to circuit A at the resonant frequency of coil Y. The coil Y was next shorted and, of course, effects of distributed capacity in it were destroyed, hence it developed impedance due to inductance, its value being above 13,000 ohms. Therefore, currents in the coil Y are stopped and reaction between the two coils is then negligible as shown by the curve D for which the resistance of the coil A increased normally from 5 to 18 ohms at these previously critical frequencies. Coil Y was next removed 6 centimeters distant from the coil A, and when resonant, gave the curve A in Fig. 6, which shows an increase to 64 ohms but quickly returned to 7 ohms at 500 kilocycles; then, by shorting the resonant

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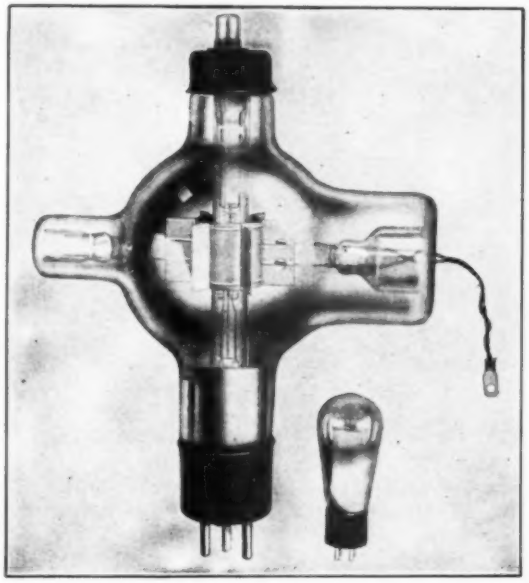
The UV-861

A Screen-Grid Tube for the High Power Amateur Transmitter

By Harold P. Westman, Technical Editor

SOME months ago we described a 75-watt screen-grid power amplifier tube known as the UX-860. The UV-861 has in relation to this tube been correctly designated for most assuredly it goes the 860 one better—and a good one at that! To begin with, its rated output is 500 watts, seven times that of the 860 and its size dwarfs practically all other glass-envelope air-cooled tubes with which the amateur is familiar. Even the 204-A, long considered a Jumbo, seems but a trifle by its side.

The 861 is designated primarily for use as a radio frequency power amplifier in transmitting circuits. As such it requires no neutralization to prevent self oscillation because the employment of the fourth element, a screen-grid, reduces the effective capacity between the control-grid and plate to but 0.50 μμfd. For stable operation though the external circuit capacity should be kept as low as possible.



THE UV-861

The tube alongside of it is not a 201-A as one might suppose; it is a UX-210. A further idea of its size might be realized when it is considered that this tube is several inches too long to be accommodated in the mounting for a 204-A. It truly is a he-man affair!

As can be seen from the photograph of the tube, it partakes of the appearance of both the 860 and the 204-A. In addition to the three large arms such as is found on the 860, there is a fourth arm of somewhat smaller proportions which acts as a support for the plate assembly. The two opposing large arms are based much as is the 204-A although the circuit connections are not the same as for that tube. The two horizontal arms support the plate which is mounted upon four metal rods. Two of these rods are sealed into a stem in each of the arms. Neither of these arms is based and the plate lead which is made up of two heavy twisted wires is taken through a seal in the larger arm. These plate leads should be twisted to prevent heating in one. This type of tube construction allows separate stems and seals to be employed upon which the various elements are mounted. The result of this greater spacing is shown in the very low capacity and high insulation resistance between the elements which makes the structure so suitable for high frequency operation.

FILAMENT

As in practically all the power tubes being manufactured today, a thoriated tungsten filament is employed. For normal operation a current of 10 amperes at 11 volts is required to heat it to the proper temperature. It is recommended that it be operated at a constant voltage as under this condition maximum operating life will be obtained. The running of the tube with less than normal voltage is not desirable as it may result in a loss of emission because the electrons are being absorbed at a faster rate than they are being supplied to the surface of the filament from its interior. The use of too high a filament voltage will cause a rapid reduction in its diameter and the life will be ended by burn-out.

The filament is supported by a single centrally located rod and because it is constructed in the shape of a double spiral or helix, it requires no tension spring whatever. This obviates the necessity of an additional support from the opposite end of

the tube in the stem of which is mounted the control grid. Such an additional support, if needed, would tend to increase the capacity between the two elements as well as reduce the resistance between them.

REACTIVATION

Fig. 1 shows the current vs. voltage characteristics of the filament. Two other curves taken for values of +5% and −5% are also shown. In Fig 2 values are plotted for the emission and filament efficiency.

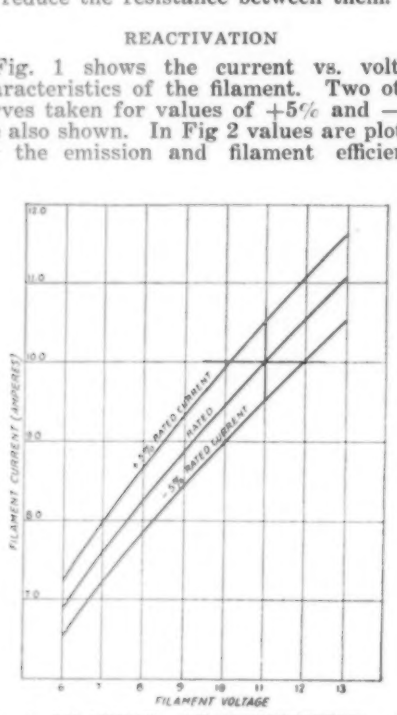


FIG. 1. FILAMENT CHARACTERISTICS ARE GIVEN FROM WHICH THE FILAMENT CURRENT FOR ANY FILAMENT VOLTAGE MAY BE OBTAINED

For convenience in calculation, curves are shown for a 5% increase and 5% decrease from the rated values.

The total emission at the rated voltage is approximately 10 amperes and the efficiency at this point is roughly equivalent to 100 milliamperes plate current per watt of filament power.

A loss of emission may be the result of an overload, insufficient filament voltage or such abuse and if no large amount of occluded gas has been driven out of the elements, it is possible to reactivate the filament by operating it at the rated voltage for ten minutes with the other electrodes free. The reactivation process may be hastened by raising the voltage to 13. Under no conditions should higher voltages be employed. The tube should be so mounted that the filament is in a vertical position; either end may be uppermost.

Whenever possible, alternating current should be used for filament heating with plate and grid returns made to a center tap on the filament heating transformer. If it is absolutely necessary to operate the filament from a direct current supply, the plate and grid returns should go to the positive leg of the filament. The filament terminates in the two prongs of a mounting similar to a 204-A grid base which caps the lower arm of the tube.

CONTROL GRID

The control grid is cylindrical and surrounds the filament. It is mounted upon four longitudinal rods and is of a comparatively coarse mesh. The effect of the control-grid voltage upon plate current for various values of plate voltage is shown in Fig. 3. From this curve it may be seen that the plate current changes but slightly for large changes in plate voltage. In Fig. 4, the effect of the control-grid voltage upon the plate current is shown for several values of screen-grid voltage and a plate voltage of 3,000. In operation the control-grid bias may be obtained by means of either a biasing battery or grid leak resistor. The control-grid terminates in what would be the plate terminal of a 204-A base.

PLATE

The plate is circular and is equipped with six generous fins or wings which allow rapid dissipation of heat and in consequence, a

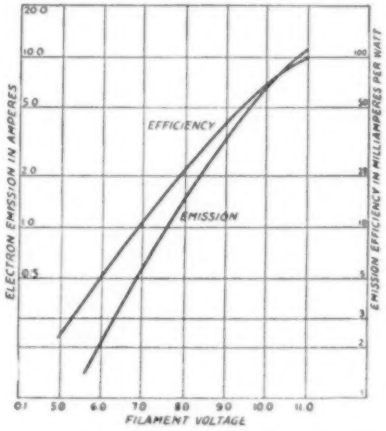


FIG. 2. THESE CURVES SHOW THE AMOUNT OF EMISSION AND THE EFFICIENCY OF THE FILAMENT AS AN EMITTER FOR VARIOUS VALUES OF FILAMENT VOLTAGE

At the operating voltage the total emission is about ten amperes, the efficiency being equivalent to 100 milliamperes of plate current for each watt of heating energy.

greater output rating than could be obtained with a plain plate. The plate dissipation should never exceed 400 watts which corresponds to a cherry red coloring. While the normal plate voltage is 3,000, it may be operated at as high as 4,000 volts

when used as an oscillator that is not being modulated. The plate dissipation under these conditions remains the same and no coloring brighter than a cherry red should be considered as indicative of proper operation. Due to the high allowable dissipation, free circulation of air about the tube is essential. When being overloaded, the use of forced ventilation is recommended to increase the factor of safety against breakdown. The tube should never be mounted in a cabinet or box restricting ventilation nor should it be placed in contact with anything or be subjected to spray or drops of liquid.

SCREEN-GRID

The screen grid is mounted just within the plate and consists of a cylindrical helix of wire supported upon four rods fastened to collars that are clamped to the stems of the based arms. The screen runs the full length of the tube, effectively shielding the plate from the other elements. It terminates at the grid pin of the 204-A base. A high capacity between the filament and

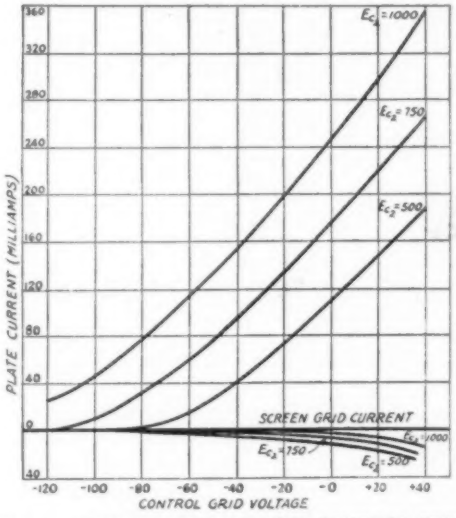


FIG. 3. THE EFFECT OF THE CONTROL-GRID VOLTAGE UPON THE PLATE CURRENT FOR THREE VALUES OF PLATE VOLTAGE IS SHOWN HERE

These curves differ from those obtained with a triode chiefly in that the increase of plate voltage has but a small effect upon the plate current. The screen voltage in all cases was 750 and a negative screen current is obtained at plate voltages of 2,000 and 3,000 for all values of control-grid voltage less than about 100 volts negative.

screen grid is desirable and a large by-pass condenser should be connected across these elements close to the tube. The screen should be at ground potential as far as radio frequency currents are concerned.

The d.c. screen voltage should be kept as low as practical and is normally about a quarter of the plate voltage. It is desirable

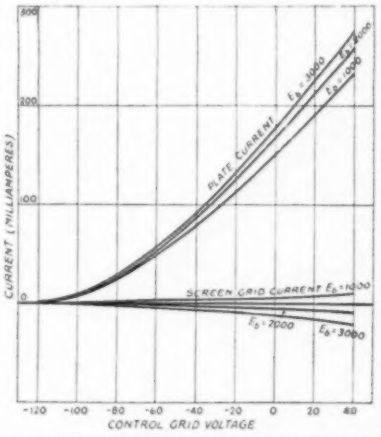


FIG. 4. THESE CURVES WERE OBTAINED WITH A PLATE VOLTAGE OF 3,000 AND SHOW THE EFFECT OF THE CONTROL-GRID VOLTAGE UPON PLATE AND SCREEN CURRENT FOR THREE VALUES OF SCREEN POTENTIAL.

As may be seen, the screen voltage has much more effect upon the plate current than has the plate voltage, curves for which appear in Figure 3. The screen current is extremely small or negative over the range of control-grid voltage plotted.

that this voltage be obtained from the plate supply. A potentiometer arrangement will be most satisfactory. Under no conditions should the plate voltage be removed while the screen voltage is still applied as the screen will then act as the plate of a three-electrod tube and the screen current will increase greatly resulting, perhaps, in its destruction. The amount of energy dissipated in the screen should never exceed 35 watts which, as in the case of the plate, corresponds to a cherry red coloring. Figs. 3, and 5 show values of screen current under various conditions; those proper for normal operation give little or no current in this circuit.

A tabulation of the general characteristics is as follows:

Filament volts	11.
Filament amperes	10.
Normal plate volts (d.c.)	3,000.
Max safe screen dissipation	35. watts.
Max safe plate dissipation continuous	400. watts.
Rated output	750. watts.

With a filament voltage of 11, a plate voltage of 3,000, a screen voltage of 750 and a control-grid voltage of 0, these values are obtained:

Amplification constant	300.
Plate impedance	133,000. ohms.
Mutual conductance	2.25 ma/v

(Continued on Page 88)

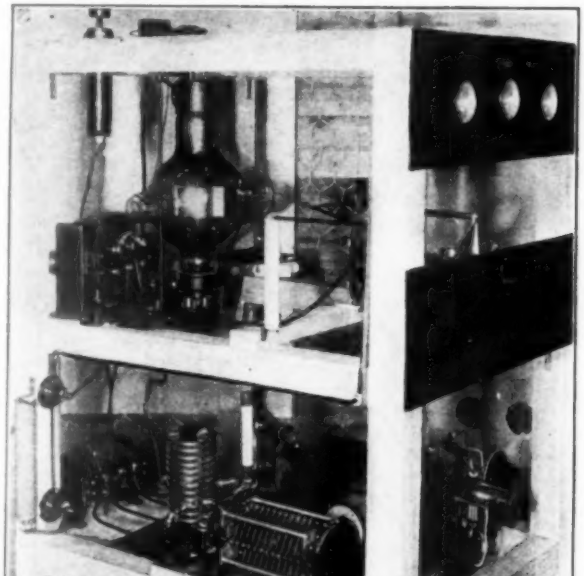
The UV-861 In Action

Concerning the Big Brother of the UX-860, Screen-Grid Tube

By Clark C. Rodimon*

THAT the four-element tube has continued further into the amateur world is evidenced by the appearance of the UV-861. With the introduction of the UX-860 some six months ago we felt that our fondest dreams of obtaining suitable tubes for power amplifier operation at high frequencies were to be realized.

Unfortunately, the man with the 204-A was not taken care of and he had the choice of giving up either the use of a screen-grid amplifier tube or a considerable amount of output power. As one simply hates to see a 204-A lie around idle while a much smaller tube is being operated, the usual result was to give up the pleasures of the use of a screen-grid tube. However, those days are gone forever, and the man who measures his output power in hundreds of watts may do well to consider the advantages of a screen-grid amplifier tube such as the UV-861. This tube has come at an opportune time—while we are housecleaning and planning new transmitters it is well to consider the advantage of screen-grid tubes.



THE 500-WATT CRYSTAL CONTROLLED TRANSMITER AT W1SZ

The framework is two feet square and four feet high and is constructed of 2" by 2" soft wood. In the lower section at the right can be seen the crystal oscillator and frequency doubling stage. In the center of the lower section appears the tank circuit of the last frequency doubling stage employing a UV-211 which can be seen by the side of the r.f. choke. The transformer at the left supplies the filament of the 211. The 861 and its associate equipment is located on the upper shelf. The tube is mounted with the control-grid at the bottom allowing a direct lead to the 211 stage. The transformer at the left supplies the filament of the 861, its output voltage being controlled by means of the Bradleystat at the top of the framework. An R.E.L. 100 μμfd. high voltage variable condenser tunes this tank circuit. The three Weston milliammeters on the panel are from left to right in the plate circuits of the 211, 861 and two 210's.

DESCRIPTION

The tube is a product of the never-ceasing development work of the Research Laboratories of the General Electric Company and is marketed by the Radio Corporation of America. Its output rating is of 500 watts (yes, ½ kw.) and the allowable plate dissipation is 400 watts. The tube construction is not unlike that of the UX-860 although the comparison should not be taken too seriously. The 861, for instance, stands eighteen inches high and has a wing spread of about thirteen inches, thus taking up quite a bit more space than the 204-A. In fact, it is one of the largest glass air-cooled tubes constructed for general operation.

In addition to the three arms such as are found on the 860, the 861 is equipped with a smaller fourth arm opposite the horizontal one that supports the plate. It is used as an additional plate support. The control-grid lead is brought out through the top arm and terminates in a special base that fits nicely into the plate mounting of a 204-A. The plate lead is brought out through the larger of the two horizontal arms and is of

*W1SZ, Editorial Dept., QST.

double-stranded wire. Both strands should be used to reduce uneven heating and resistance losses which may become important at high frequencies. At the base of the tube are brought out the screen-grid and filament leads. The familiar grid-filament mounting for the 204-A fits into the picture here, also.

OPERATION

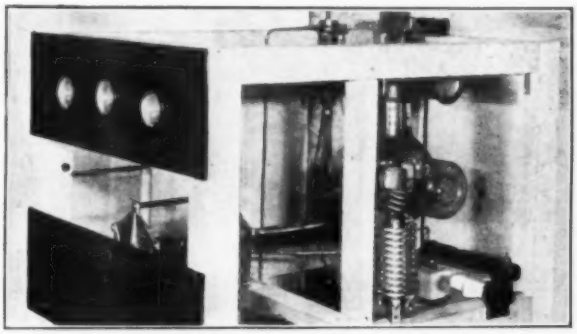
The tube is designed for power amplifier use at high frequencies. According to theory, it should be possible to operate it at the same frequency as the oscillator or preceding stage *without* the need of neutralization—that comparatively simple process whereby a tube may be made to act as it should but which said simple process seems to be a great mental hazard, if nothing else, to the amateur in general. As above, the tube should not need to be neutralized—and in practice it doesn't. Now are we all happy? The fellow with the large oscillator tube may now use an 861 to advantage and should said person be of the type who detests tackling the art of neutralization he needn't tackle this bit of black magic.

AN 861 SET-UP

The transmitter at W1SZ in which the 861 is employed is controlled by a crystal in the 3,500-kc. band. The crystal tube is a 210 which obtains its plate voltage from a small Acme transformer. A Raytheon BH tube acts as the rectifier and although the 400-volt output is more than the tube is rated to handle it has given no trouble. This supply also handles the first frequency doubler, a 210, the output of which is in the 7,000-kc. band. There being but one milliammeter available, it serves for both the 210's. Grid bias for the oscillator is about 45 volts and for the first frequency doubler is 250 volts. The second frequency doubler which puts us in the 14,000-kc. band is a UV-211. Its plate voltage is realized from the main supply to the 861 through a 10,000-ohm resistor. The optimum bias for the 211 will be less than that needed for the 210 doubler and in this case 125 volts were plenty. The bias is obtained from Burgess "B" batteries. The 861 stage operates on the same frequency as does the 211. The control-grid bias is obtained from a separate battery. This is not absolutely necessary but an extra battery was available and we were not placing too much faith in our r.f. chokes. The bias voltage doesn't seem to be critical so treat yourself to a small 45-volt battery and be on the safe side. There being no current drain from this battery, its life is long. In operation little difference was noted between 22.5 and 45 volts.

TUNING UP

The next hardest step is the tuning up process though one usually looks forward to this. It might be well to start with the subject of r.f. chokes, a point which should not be overlooked if one wants to be saved both time and grief later on in the proceedings. R.f. chokes with some choking effect are needed in all negative bias leads. Use chokes to which you have been accustomed in the past providing you have not found them to be faultly before this. It might be well to start off with the oscillator and test each stage with a neon tube. Should there be any glow at the battery end of the choke it should be ripped out and a choke substituted that will stand up under the neon tube test. When you are reasonably sure that the chokes in the crystal stage are suitable, it is time to proceed to the first frequency doubler.



A CLOSE-UP OF THE 861 STAGE TAKEN FROM A DIFFERENT ANGLE

This photo shows the method of coupling the antenna to the amplifier inductance. At the right of the inductance may be seen the resistors for the screen-grid voltage. An idea of the size of 861 may be had when it is seen that it takes up nearly the two feet of height in the amplifier stage.

When the tank circuit of the 210 doubler is tuned to twice the crystal frequency there will be a drop in plate current that will be indicated on the milliammeter which is in the common supply lead to the two 210 tubes. With the tank circuit adjusted for the greatest plate current dip, go back to the oscillator stage and run the condenser up toward maximum until the crystal tube stops oscillating. After noting where the point is at which oscillations stop, swing the condenser back to zero and proceed upward again, this time coming nearly to the point at which oscillations cease and be satisfied that you have maximum output from those two tube circuits. When these two condensers are finally adjusted they need never be touched again unless the r.f. coupling lead between the stages is shifted.

Now, try the neon tube on the chokes in the doubling stage and when the chokes

show no r.f. at the low end, we will take it for granted that there is no r.f. feed back through a bum choke. If this surmise is correct, all will be well; when the crystal stops oscillating the milliammeter will drop and by turning the condenser of choke back all unwanted r.f. Should there be much r.f. getting back into the preceding stages you may easily wreck that fragile little slab of silica known as a crystal.

When the 211 stage was first operated,

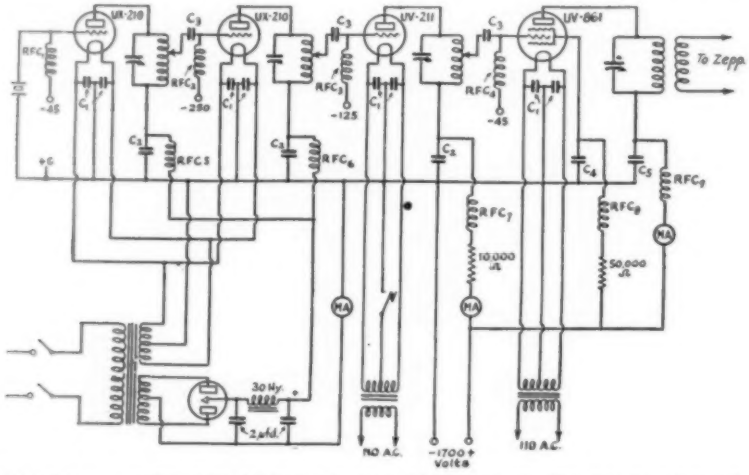


FIGURE 1. THE SCHEMATIC WIRING DIAGRAM IS SHOWN HEREWITH.

The plate supply for the last two stages is obtained from a motor-generator set. C4 should be of large capacity. Preferably a 1-μfd. filter condenser if you can spare one.

C1 have a capacity of .006 μfds.

C2 are .02 μfds.

C3 are .003 μfds.

The r.f. chokes are all on 1" test tubes. The chokes above 7000 kc. were made of about 350 turns of No. 34 enamelled wire. The chokes in the 7000 kc. portion of the transmitter were the same with the exception that only 250 turns were used on the test tubes. On 14,000 kc. 200 turns were found about correct.

Keying is shown in the filament of the UV-211. Another place that is easy to key is between the r.f. choke and the negative bias for the control grid of the UV-861.

the amplifier stage nothing will happen, the circuit will not start to oscillate of its own accord.

The next step is to light the filament of the 211 and apply the plate voltage, the bias being already on, of course. We aren't going to worry about keying yet so use the switch in the plate voltage supply line to turn the power off and on. Tune the output tank of this stage to twice the frequency of the preceding 210 at which point, the milliammeter in the plate lead will take a dive up to about 100 mils. Now, stop the crystal from oscillating. The milliammeter in the 211 stage doesn't drop at all! She must be oscillating. By listening on the monitor you will soon have your suspicions verified. Try the neon tube on the choke. It will probably be ablaze through the entirety of the choke. Fine—all you have to do now is wind chokes for the rest of the evening with your thoughts on what you are doing and far away from DX. Do not turn the crystal stage on again until this choke in the bias lead has been made to the Raytheon rectifier tube glowed brightly because the choke was no good and plenty of r.f. was getting back into the power supply of the crystal and first doubler tubes. From this it can be seen that it is not without justification that the point of needing effective r.f. chokes is stressed. When things are as they should be, with the crystal oscillator stopped or the first frequency doubler detuned, there is no plate current for the 211. With the crystal oscillating and the doublers working, there will be about 100 mils representing about 100 watts input to the 211. This is more than sufficient to swing the grid of the 861 when it is considered that the input to this power stage is but 350 watts. It should be sufficient to control inputs up to at least a kilowatt and what amateur needs *half* that?

The next step is to get the 861 controlled by the 211 output. Heretofore when frequency doubling we have had no trouble getting the various stages to mote as they

should but now we are tackling something of a different nature. In the past we have sweat, tuned and cracked crystals by running up the output of the crystal stage in order to control a 204-A in the 14,000-kc. band. We have never had much luck and always went back to the self-excited circuits. Perhaps, we can get this amplifier stage working without getting discouraged and following precedents set before.

With about 45 volts on the control grid, we turn on the plate voltage to the 861 which automatically applies voltage to the screen-grid, that element being supplied from the plate source through a resistance of about 50,000 ohms. The tank condenser of the 861 is run through its range and if the amplifier doesn't start operating, either the 861 is not getting enough excitation or the 211 stage has been detuned by attaching the grid clip to feed the 861 stage. To correct the first fault, move the grid clip up nearer the plate end of the 211 stage tank coil. Very little coupling was needed in this case, two turns being ample. The tank of the 211 is then retuned, this time noting any little increase in plate current to the 861. At the point where the plate milliammeter shows a slight increase, the 211 stage is in step and the 861 tank circuit should be adjusted until maximum plate current is obtained. By detuning the previous stages or abruptly stopping the crystal from oscillating, one can check whether or not the 861 stage is oscillating of its own accord. This may not be the final check, so detune the 861 tank circuit and see if it is possible to get any output on other frequencies that are not regular harmonics. If no response is had, you may be sure that the output is crystal controlled and by checking this with the monitor you will find a steady d.c. shrill note with no change in frequency when the condensers are detuned, merely a change in audibility.

Let's see what happens if we try to put in a neutralizing condenser. True, the final stage is not oscillating at present but we have visions of the past in which nice oscillating crystals were taken out of the holder—chips. Looking around, we find a double-spaced condenser capable of standing the high voltage which will be impressed across its terminals in this case. The stator of the condenser is connected a few turns below the low end of the plate coil and the rotor goes to the control grid. By adjusting this condenser, the input to the tube may be varied although it is not as critical as we thought it would be.

Let's couple the antenna and see what effect it has upon the output. With the antenna coupled and no neutralization, we note the input to the 861. Now we note the maximum antenna current and insert the neutralizing condenser. With some adjustments, the antenna current can be made to increase considerably. Fine! Obviously, this isn't due to a more perfect balance but is caused by increased regeneration in the amplifier stage. However, inasmuch as the circuit shows no tendency toward self oscillation we might just as well take advantage of the fact and use this extra output. We aren't worrying about creapage, over heating of tubes, et cetera; all we want is maximum output in that little sky-

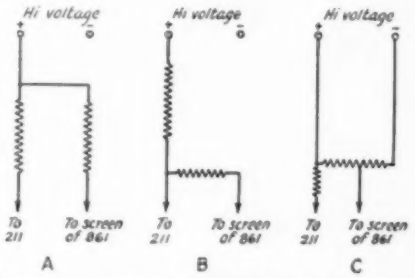


FIGURE 2. THREE METHODS OF OBTAINING VOLTAGE FOR THE SCREEN-GRID ARE SHOWN ABOVE

A is the arrangement employed, the screen being connected to the plate supply through a resistor. A separate resistor drops the voltage to the plate of the 211 stage. At B, advantage is taken of the drop across the resistor in the plate lead of the 211. This is not so good in that it offers a coupling between the two stages and the voltage on the screen will vary when the current through the plate circuit of the 211 changes. At C we have a simple potentiometer method which is most suitable but requires more resistance than the other two arrangements.

wire at the one frequency set by the crystal and we don't care how we get it.

Suppose we get critical now. By listening closely on the monitor we realize a very nice signal although it is not d.c. Let's put some filter on the generator. With 2 mikes on the output of it there is no discernible improvement. Wait, this generator is just feeding the amplifier tubes which are controlled by the crystal oscillator. No matter how pure the amplifier supply may be, it will have little or no effect *if the oscillator supply is not as good.* Well, we don't mind that a bit because the oscillator supply does not call for high voltage equipment so the original 2 mikes in the oscillator plate supply was expanded to a brute force affair of 2 mikes, thirty henries and 2 mikes. A listen on the monitor indicates that the note from the crystal is more like it should be, as pure d.c. as one would want. With the amplifiers in operation, the signal is louder but that's all. No change in note is noticed.

Considering the cost of a crystal controlled set, it would seem that one big item in its favor to stack up against the "out of the question" expenses involved is the fact

that a comparatively rough amplifier plate supply will be practically as suitable as one that is adequately filtered. Anyone who has tried to filter 2,500 volts knows that it takes a large outlay of cash to accommodate this item. And now that Christmas and New Year's day is past with the bills coming through in every mail this fact can be brought home stronger than ever. Therefore it can be seen that putting in crystal control on a high powered outfit would offset the filter expense—and what a fine signal you will have for this first year in our new channels. We don't want rock crushers any more. Signals that cover 5 and 10 kc. are absolutely taboo now. Why not have all that power concentrated on one frequency and make it stay there!

KEYING

This subject has been left to the last because it was not needed up forward in this script. In the past it seems that many with crystals have keyed so that there would be a back-wave on the air at all times. They seem to think it necessary to impress upon others the fact that they have crystals as if we couldn't tell by listening to them. They may be keying in the bias lead under conditions that do not drop the plate current to zero when the key is open. They may be keying in the antenna and due to the capacity between the key contacts, the current does not fall to zero. Any method of keying which allows a signal to be emitted while the key is up shows a distinct lack of courtesy on the part of the operator. Give the man with a weaker signal the chance to bust through your racket. It seems to me to be nothing more than poor etiquette to continue to use such methods of keying. We are not living in the past. We must realize that every kilocycle is valuable. Why should a signal take any more space in the spectrum than is absolutely necessary to carry on the correspondence at hand. With these arguments in the back of our head we resolved that we were not going to be an air hog.

A separate filament heating transformer was installed for the 211 stage and the key was located in the center tap lead. While this does not allow the load to be kept on the tube at all times and the heating and cooling of the tube will change its capacity, the crystal will take care of these changes. That's why it's being used! No key clicks have been noted so far and there is no lag in the keying. We can go ahead just as we used to when we were handling traffic with Himoe at WNP last year and he would tell us to "speed her up" when we would get tired of wagging the bug back and forth at the speed he wanted to copy. Back wave —there is none. There can't be. The whole 14,000-kc. equipment is dead until we punch the key. And that's as it should be.

CONCLUSION

This lay-out is not described because we think it a station with great merits. We don't believe it has any. The set itself in appearance is not the type of mechanical work we wish we had done. The 861 was acquired to see if it would work as we had hoped it would. We, therefore, hooked it up in an experimental layout to see what the results would be. We have seen and wish now that we had taken the pains to do the tube justice.

The capacity of the wiring in all stages should be kept at a minimum. This is especially necessary if no shielding and neutralization is contemplated and applies particularly to the last two stages. Should feedback start here and and get back through r.f. chokes the poor crystal would have to buck a considerable amount of power and fail in the attempt.

Let it be said here that one cannot take too much precaution in the crystal stage. Should this link be weak your chain will never break—it will never even get into action. It is well worth the expense to get a real power crystal that will stand 450 to 500 volts. A crystal with one frequency quite close to another will slide back and forth and had best be used as a souvenir rather than an oscillating blank. A crystal that will not step right up when the power is applied should be washed and put in a weather and dust proof mounting. If it still fails to mote at every crack, the bias on the crystal tube should be lowered and if it still persists in being backward about starting to oscillate, it should join the ranks of the first example of "what-not-to-be for crystals". You will derive little enjoyment from a crystal set if you are always poking at the crystal to get it started. The crystal should be put in the holder and forgotten for some months to come. Only in this way can maximum enjoyment be derived from crystal control and let me say that real enjoyment is obtained from it. Always the same character of signal, always on the same frequency and always ready to go.

Reports on W1SZ have been very gratifying but no more than we expect. We can tell by listening to the monitor that the emissions are of a "1929" quality and no mistake. We aren't going to operate the set only in the 14,000-kc. band either. When we want to operate on 7,000-kc. we will cut out the 210 frequency doubler and tune the 211 stage to 7,000 kc. Then the 861 will be run down to the lower frequency. For 3,500-kc. operation, the 211 stage will be neutralized and operated at the crystal frequency and follow with the 861 also at the same frequency.

A Multi-Range Voltmeter

By Harold P. Westman, Technical Editor

BECAUSE meters are expensive as seen from a dollars and cents point of view, it seems silly to spend a given amount of money for several meters in order to cover those ranges that are necessary in the general run of amateur work. How much better it would be to get one meter and make it do the work of a whole family providing, of course, that no serious losses are entailed either in accuracy or convenience.

Take for example the problem of measuring d.c. voltage. There are about three ranges of voltmeters that would be needed around the average station. First there is the matter of checking filament voltages on all sorts of receiving tubes. This requires a meter having a range not exceeding ten or fifteen volts or the lower readings will be inaccurate. Next we have "B" batteries to test and a range of at least fifty volts is necessary here. We then have the higher ranges of voltages used on the plates of transmitting tubes. In addition to these, it is a rare amateur who is not at least occasionally called upon to check over the neighbor's broadcast receiver. For this job, a high resistance voltmeter going to at least two hundred volts is necessary to measure the output of the "B" battery substitute usually installed. Needless to say, the three or four instruments necessary to take care of these common direct current voltage measurements are collectively quite expensive and for work of this type not requiring very great accuracy, it is possible to come out somewhat ahead of the game by making up a multi-range voltmeter that will be capable of doing all these jobs and some in addition.

Fortunately, it is possible to purchase low range milliammeters at a price within reason. Resistance units that are suitable for use as multipliers may also be obtained without the necessity of robbing a bank. Thus we have the "works" for a voltmeter and all that remains is to put two and two together and see that the result is four.

The instrument shown in the accompanying photo has six ranges as a voltmeter in addition to its regular range as a milliammeter. It consists primarily of a Weston 0-1.5 milliammeter and eight resistors that comprise the multiplier. If we desire a range of 1.5 volts, Ohm's Law prescribes a resistance of 1,000 ohms to give 1.5 milliamperes through the meter at that voltage. The resistance of the meter is comparatively low and can be neglected. The inaccuracy due to the meter resistance will be greatest when the lowest value of multiplier is used. This is at the low voltage range where a check can most easily be obtained. We also see that the meter, giving a full scale deflection with but 1.5 milliamperes, is suitable for measuring the output of "B" battery substitutes because the insignificant current drain will not affect the operation of such a device.

The six ranges provided give full scale deflections of 1.5, 15, 150, 300, 750 and 1,500



THE GENERAL APPEARANCE OF THE METER MAY BE SEEN ABOVE. No cover is provided, it being considered unnecessary. Although if the unit is to be used for the servicing of broadcast receivers or other work requiring good portability, it would be very desirable that one be made. Small rubber feet are attached to the bottom to prevent scratching of both the meter and table top and a small leather handle is fastened to the top side.

volts and a binding post is included which allows the milliammeter, as such, to be used. These ranges give satisfactory overlap when going from one to another and cover practically all the values of voltage that are normally found in the ordinary station. It is very probable that higher voltages are being used by some amateurs and it is a simple matter to obtain different sizes of resistors and thus extend the range of the meter. It should be practical to cover well up towards 5,000 volts if that is desirable although in general the 1,500-volt range should be sufficient.

Super-Davohm resistor units manufactured by the Daven people are employed as the multipliers. These units are wire wound and resemble a grid leak that has had too much turkey for Christmas. While of

the standard grid leak length, they are materially thicker and have heavy brass ends which fit into standard grid leak mountings. They are obtainable in various sizes between five hundred ohms and five megohms and are guaranteed to be within

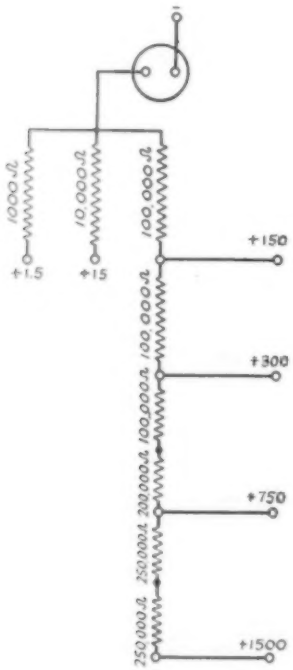
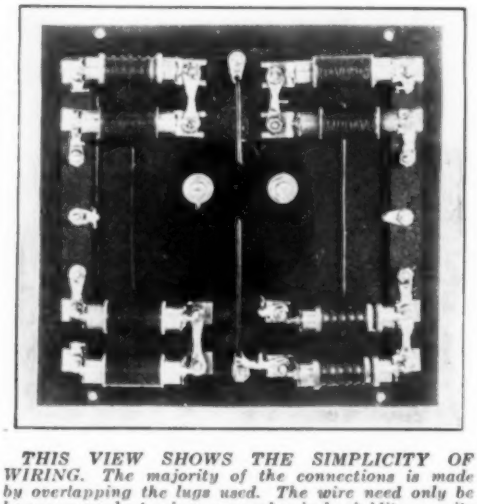


FIGURE 1

1% of their rated values. If we assume the resistor to be off by that amount and the meter to be inaccurate to 0.5%, the total inaccuracy will be approximately 1.5% which will not be damaging as far as the general run of amateur work is concerned. As a matter of fact, there is usually too much stress placed upon the accuracy of the meters used and too little upon the reading of them and the reasoning employed in the making of most measurements. Folks that brag about the meters they have that are good to the 'steenth place, oftentimes have a mentality good to about one decimal place and sometimes not quite that. The result of most amateur measurement work depends not so much upon extreme precision in the actual measurement of the circuit values as it does upon the accuracy with which the values so obtained are handled by the worker. Outside of the measurement of filament voltage which has a large effect upon the life of a tube, there are precious few measurements the amateur makes that require an accuracy greater than 2%.

To get back to our meter. Figure 1 shows the value and position of each resistor employed. Two 250,000-ohm units are required for the last step in order to handle the full-scale current of the meter and still allow sufficient safety against burn out. The resistors are capable of dissipating 1 watt and the maximum current that should be passed through the 250,000-ohm units will be 2 mils. This allows an overload of approximately 30% which should be sufficient for most work. A 500,000-ohm unit (the next larger size) would be capable of passing only 1.41 mils and would be unsuitable. In Figure 2, appears a simple plan view of the layout of the units. It is a back-of-panel view and as can be seen, the majority of connections can be made by overlapping lugs, there being comparatively few wires necessary. This is shown in the interior view. The list of parts needed is given below and while the total cost may seem appreciable at first, when compared with the cost of a 1,500-volt meter that has but a



THIS VIEW SHOWS THE SIMPLICITY OF WIRING. The majority of the connections is made by overlapping the lugs used. The wire need only be heavy enough to insure mechanical rigidity as its resistance is insignificant. The insulation should be good as the difference in potential is several hundred volts and may be impressed across portions of the circuit. Some of the paper labels have been removed from the units to show their construction. If high humidity is encountered, it might be good to remove the paper which may act as a parallel resistance path to the winding. This applies particularly to the very high values of resistance that would be used in meters giving full scale deflections for three or four thousand volts.

single range and is not suitable for measurements of low voltages, it is really quite reasonable.

1 0-1.5 milliammeter	$12.00
1 panel 7" by 6.5" by 3/16" Bakelite	.75
Engraving on panel	2.75

(Continued on Page 84)

Experimenters' Section

IN OUR December report, there was presented to all a problem concerning the recording of clock beats and in particular the need for some satisfactory method of indicating the start of each minute upon the chronogram. Apparently, there was considerable interest generated upon the part of the Experimenter and we are presenting some of the solutions suggested.

7 Kirkland Street,
Cambridge, Mass.

Editor, *QST*:

Mr. D. F. Brocchi has described in the "Experimenters' Section Report" (page 46) of the December, *QST* a method of operating a chronograph from a clock. He has succeeded in recording the seconds but wants suggestions for satisfactorily recording the minutes. I offer a scheme which has occurred to me and which, I think, could be easily carried out.

Instead of taking the once-a-minute impulse from the clock itself, it can be taken from a separate instrument controlled by the relay. All that is necessary is an anchor escapement with a suitable wheel and an electrically driven rocker. Figure 1 shows the general idea although details have not been developed.

The device may be mounted upon a wall in which case the wheel can be driven by a weight; or, if a portable appliance is wanted, a spring drive must be used. I assume that Mr. Brocchi's relay acts once a second but that is not important. However, every time the relay acts the escapement wheel will turn one notch. A wheel of suitable size (probably 60 teeth) can be chosen to make one revolution per minute. A contact arm can be attached either to the wheel or to its shaft and the once-a-minute interruption effected in any way desired. The magnet coil can be connected in series or in parallel with the chronograph or it may be connected to a separate relay. Care must be taken that the interruption of the chronograph does not affect the escapement.

A dial may be made to show the position of the contact arm so that any failure of the escapement could be detected by comparison with the second hand of the clock.

I hope this suggestion may be of use.

—*Laurence Bachelder, W1AWU.*

1511 Poplar Street,
Terre Haute, Ind.

Editor, *QST*:

Referring to the request in the December issue for some method of making a minute marker for a chronograph, I wish to submit the following idea. The method herewith suggested may be given a trial if all the conditions are acceptable to Mr. D. F. Brocchi, who, according to his description of the work already done on the clock is, no doubt, a very skilled artisan and will appreciate the fine points involved.

Assuming that the clock has a deadbeat or Graham escapement and beats seconds, the scape wheel makes one revolution every minute.

Drill a very small hole in the rim of the scape wheel and drive in a small pin such as the hardened and polished end of a small sized cambric needle leaving about 1/8 to 3/16 inch projecting on one side of the wheel.

Then mount on a thin slab of bakelite two small contact springs as follows. The springs should be of 14-karat *yellow* gold on account of the almost frictionless slip this

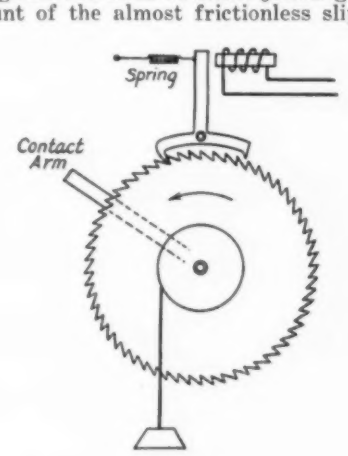


FIGURE 1

metal presents to steel, and the contact points should be tipped with platinum, or the springs may be made of 10% iridium platinum.

The springs proper should be about 0.001 inch thick by 0.01 in. wide and from 3/4 to 1 inch long. They should be soldered to heavier base pieces which are screwed to the bakelite slab so that the springs project beyond one end of the bakelite to their full length, one being on top and the other on the bottom. Bend the end of the tap spring down at right angles and provide a stop to arrest its downward motion at a certain point. Then make a V bend in the under or wiper spring and let the end extend a safe distance beyond the V

(Continued on Page 78)

I.A.R.U. NEWS

Conducted by A. L. Budlong

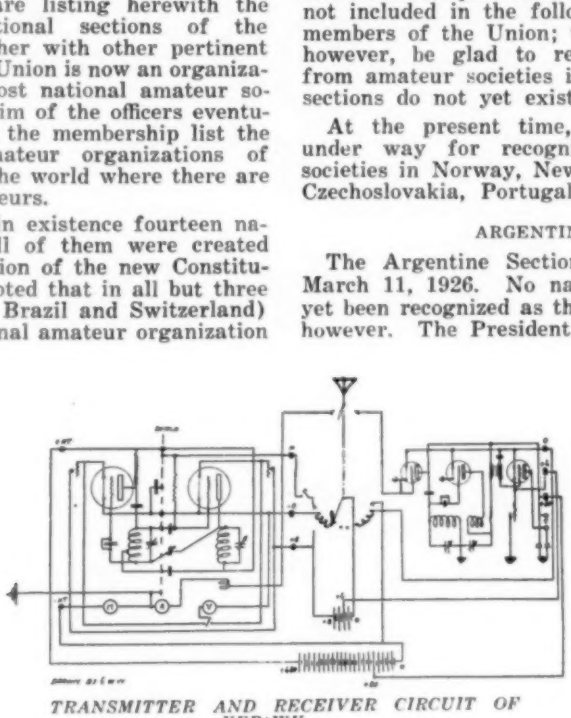
National Sections of I. A. R. U.

FOR the information of readers everywhere, we are listing herewith the existing national sections of the Union, together with other pertinent information. The Union is now an organization of the foremost national amateur societies; it is the aim of the officers eventually to include on the membership list the representative amateur organizations of every country in the world where there are transmitting amateurs.

There are now in existence fourteen national sections. All of them were created prior to the adoption of the new Constitution. It will be noted that in all but three cases (Argentina, Brazil and Switzerland) the foremost national amateur organization has been recognized as the national section. In a recent visit to headquarters, Mr. Abreu, president of the Brazilian Section, expressed his desire to take the same step in Brazil immediately on his return to his own country.

It has been noted that some societies in various countries, while not actually members of the Union, are so stating on their letterheads. We must point out that in all cases it is necessary to formally make application to Union headquarters before any society can be recognized as the national section for its particular country. Societies not included in the following list are not members of the Union; the secretary will, however, be glad to receive applications from amateur societies in countries where sections do not yet exist.

At the present time, negotiations are under way for recognition of national societies in Norway, New Zealand, Poland, Czechoslovakia, Portugal and Denmark.



TRANSMITTER AND RECEIVER CIRCUIT OF XEB4WK

ARGENTINA

The Argentine Section was formed on March 11, 1926. No national society has yet been recognized as the national section, however. The President of the Section is Mr. Enrique L. Repetto, Santa Fe 1592, 60 Piso D. 12, Buenos Aires.

AUSTRALIA

The Australian Section was created on August 6, 1927, and on January 24, 1928, the Wireless Institute of Australia was recognized as the National Section. Correspondence should be addressed to the Hon. Fed. Sec'y, Mr. Bruce Hardie, 22 Missouri Ave., Garden Vale, Melbourne.

(Continued on Page 60)

Calls Heard



W. R. Jardine, 264 Buckley St., Essendon, W5 Victoria, Australia.

w1sf w2com w2exl w2xaf w2xad w4rn w4tk w5acl w5bj w5pa w5ql w6aqj w6am w6avj w6chk w6cwm w6dkv w6dny w8bal w8bhi w8cam w8dgp w9chs w9com w9dgz w9ef w9eij w9eln w9ln od-1jr oo-1aj op-1cm op-9pb op-1pw op-1hr oh-6avl oh-6qh oh-6eck se-1ea nz-ez5 nz-nba am-ane oz-1ac oz-1an oz-1ap oz-ax oz-1fb oz-1fm oz-1fw oz-2ab oz-2at oz-2aw oz-2ax oz-2aj oz-2be oz-2bp oz-2bg oz-2bf oz-2bv oz-2go oz-3aj oz-3ar oz-3at oz-3av oz-3aw oz-3az oz-3cd oz-3cg oz-4ae oz-4av oz-4ao jkzb.

SS Westerner, WBCS, J. S. Morgan, Jr., Operator.

w1aaw w1bal w1bea w1bgm w1bob w1cfi w1cmp w1cow w1cra w1chc w1jr w1kk w1kn w1mk w1rd w1wv w2aau w2acd w2afa w2aft w2aib w2beh w2bhr w2bhv w2boz w2fp w2ja w2jd w2md w2vi w3acu w3afx w3ahp w3avl w3bnu w3cdn w3ckl w3gt w3ia w3mt w3uo w3zzc w4adb w4afc w4afe w4ale w4cs w4cv w4gw w4pf w4ft w4tk w4nl w5afx w5ain w5yg w6aak w6bam w6bax w6bws w6cho w6cvj w6czk w6dli w6no w6vz w7ek w8ads w8ath w8bau w8baz w8bcu w8che w8cnt w8drj w8dyi w8dyz w8kr w8uk w8xe w9avp w9cos w9erd w9dck w0dek w9fax w9fi w9gdh velbr ve2ca ve3ay ve3bc ve3ia ve4gi ct-1bl ct-1cn cr-3am eb-4cn eb-4fe eb-4re eb-4uo ec-1ug ed-7ah ee-ear37 ee-ear53 ee-earn ef-8btr ef-8est ef-8gdl ef-8jc ef-8rk ef-8rrm ei-1fu ej-7dd ek-4ar ek-4dkf xen-ja et-tpar g2ao g5by g5wq g6br g6wy g6yq g6uj klnf awsw wnbt.

C. R. Plant, 1 Albert Rd., Northenden, Manchester, England.

w5mx w6ad w6aoe w6bco w6blx w6bvx w6cmd w6cjp w6dto w6eeo w6eii w6hm w6gi w6kd w7aik w7if w7tu op-1ad op-1cm op-1cy op-1hm op-1hr op-1pw ac-1ax ac-4aw ac-8zw od-5az as-12ra as-1ap as-2ber as-rao3 w5afx w6agg w6afx w6bcc w6blx w6cjp w6cci w6dhs w6dfu w6dy w6dc w6czk ac-1pp ac-1wl ac-1tb ac-2ab ac-2mo ac-2tn op-1ah op-1gz aj-jpbc aj-7cb aj-4ef oa-2og oa-3lp oa-4cg oa-4mf oz-1ax as-1ae as-1ak eu-2cy eu-4ai ef-8gj au-8aa xnu-4eff.

W8DED, Russell Sakkers, 53 East 7th St., Holland, Michigan.

(3500-3550 Kc. fones)

w1akd w1ayl w1ayo w1cks w1bjq w1cz w1ht w2aow w2ahl w2ahm w2atq w2bee w2el w2gj w2st w3ac w3aeq w3ain w3akw w3bqp w3bsz w3bup w3cah w3cc w3cjr w3oo w3qv w3sl w3sn w4aht w5axl w8abu w8aci w8adf w8aef w8aei w8ahf w8ajh w8ako w8akv w8ano w8ath w8aub w8avu w8avq w8ayl w8bas w8bhn w8bhf w8bld w8bot w8buw w8ccz w8cfy w8cgo w8ckd w8cj w8cqi w8cwe w8cwu w8dpd w8day w8dt w8dus w8dvf w8dvq w8dvw w8dwm w8dxy w8lt w8rd w8rw w8pk w8zg w9afv w9agq w9aho w9ahk w9agy w9ala w9ayl w9bcm w9beu w9bch w9bka w9bwi w9bzq w9cch w9che w9emt w9eym w9ezz w9ek w9fvl w9fzl w9so w9mm w9mq w9qd ve3et.

XEN-OQQ, S. S. Helder, Heard of West African Coast

On 20 meters

w1aep w1ang w1aqt w1bjd w1blv w1cfi w1cjc w1cra w1fs w1mx w1ry w1sz w1zz w2aan w2aog w2api w2atk w2arb w2avg w2azu w2baa w2bcw w2bds w2bjg w2bjs w2bjv w2boa w2box w2bps w2brb w2ch w2cjx w2cuz w2dr w2fp w2jn w2lx w2mb w2md w2rs w3amw w3aqm w3bjm w3jm w3ky w4rn w4ft w5avs w5nb w5om w5wz w5yd w6csw w6czk w6dev w6zzd w7tu w8abw w8ady w8afq w8ann w8aur w8bcu w8cbd w8ccl w8dyk w8hx w8jj w9aji w9alm w9efk w9enr w9eqk w9etd w9fyp velap ve2ap ve3cs ve3bm ve4fv sa-fc6 sb-1cm su-2ak fo-a7d fo-a7n rwx wsq.

30-40 meters

w1awm w1cmp w1ic w1mx w2atr w2ja w2jdw w4tk w4vp w5ux w6awa w8abw w8aff w8ajy w8baz w8adg w8bcu w8brh w9bqe sa-en8 sa-je7 sb-1bl sb-1bs sb-1cm sb-1ls sb-2ak sb-7ab sc-2ab ef-8btr ef-8cdb ef-8jf ef-8kf eb-4wx eb-4ft xeb-4wk eu-2ai nj-2pa fl-1ab fo-a7u fg-ocdl fg-ocya fg-pm.

Basil Hall, 25, Coombe Gardens, New Malden, Surrey, England.

30-50 meters

w1aao w1aqt w1chc w1cmp w2alu w2arq w2atq w2azk w2bgo w2com w2czr w2jd w2jdw w3afw w3awb w3avl w3bce w3ckl w3qe w3sz w3uo w4ca w4rn w5jc w8adg w8ann w8bau w8dnm wduw w8dyz w8xe w9arn w9beh w9bsh w9cav w9cmv w9cn w9cps w9dgz w9ecs w9ejo w9fkf w9ln w9us ct-1au ct-1bv ct-1ca ct-1cf ct-1cn ct-1ct ea-es ea-fay ea-fy ea-hz ea-lr ea-lrk ea-lrs ea-py ea-r28 ea-ra ea-w5 ea-wg ea-4lr ec-1ema ec-1na ec-2lo ec-2rm ed-7ah ed-7cr ed-7ln ed-7rc ee-ear16 ei-1as ei-1dr ei-1po el-1alk el-1a2b el-1a2g el-1a5m em-smua em-smux em-smve em-smxh em-smzf em-smzy er-5af es-1co es-2nae es-2nap es-2nm es-2nx es-5ng es-5nk es-5nl es-7nb et-pzz et-tpar et-tpa et-tpfm et-tpmn et-tppt et-2as eu-e8pm eu-nno eu-2aee eu-2ai eu-2bb eu-2bu eu-2df eu-2dw eu-5ae eu-5az eu-43ra eu-25rb eu-85rb ew-ac ew-an ew-au ew-bj ew-fv em-hp ew-hlo ew-ox fe-egez fm-8ev fm-8rit ha-mfv oa-2ek oa-2jc oa-2jy oa-2rb oa-2yj oa-3hl oa-3jk oa-7ah oz-2go oz-3ar sb-2ak sb-2bc sc-2ab velbx ve2ca.

14-27 meters

w1ack w1alb w1alg w1aqt w1aze w1bbt w1bby w1bfz w1bil w1blv w1bpd w1cfi w1cjc w1cmf w1fb w1kq w1mx w1ry w1sq w1sz w2aef w2ag w2api w2arb w2avg w2avz w2azl w2azu w2beq w2bgq w2bkf w2bmk w2bum w2bw w2ch w2cjx w2cvj w2fp w2hma w2hq w2jn w2md w2rs w2tso w3aqr w3eq w3ga w3ia w4ft w4nh w8aac w8aav w8adg w8agy w8ail w8arx w8avs w8axa w8ccw w8cds w8cp w8cwt w8cyg w8hx w9as ct-1cf ct-1cu ea-1r ea-4sn ec-1rf ed-7hp ed-7va ei-1gc em-smux es-2nt es-5nl et-tpkx eu-2bv ew-sn fk-4ms fm-8rit fm--8vx fo-a3a fo-a40 fo-a5l fo-a7d velap velar ve2ac ve2al ve2bb ve2bg ve2ca ve2jj.

EC-RP18, Henry Rakosnik, Sedlecpod Kankcm.

ec-1rf ec-1ab ec-1na ec-aa2 ec-1ema ec-1yl ec-1uz ec-1rv ec-1mx ec-1fm ec-1kj ec-1mk ec-2lo ec-2et ec-2ny ec-2un ec-2yd ec-2pa ec-2rm ec-2cm ec-3sk ec-3us ec-3wa ec-4av ec-4qo ed-7va ed-7vo ed-7ab ed-7tm ed-7bt ed-7hp ed-7er ed-7ek ed-7dm ed-7wh ed-7bb ed-7ah ed-7ln ed-7sh ed-7cg ed-7am ed-7om ee-ear52 ee-ear62 ee-ear61 ee-ear ee-ear18 ee-ear28 ee-ear98 ee-ear104 ee-earc26 ef-8klm ef-8flm ef-8aya ef-8bas ef-8ral ef-8mpg ef-8gkc ef-8lcm ef-8ei ef-8tdq ef-8nox ef-8tq ef-8xzl ef-8io g6wy g6fa g6wl g6zr g6yl g5hk g5gu g6bz g5rm g2bm g2hu g2hq gw-16b gi-6w eh-9mq

(Continued on Page 74)

Correspondence

The Publishers of QST assume no responsibility for statements made herein by correspondents.



The New Regulations

Department of Commerce,
Radio Division,
Washington.
December 19, 1928.

My dear Mr. Warner:

The Division has your letter of the 11th instant requesting information relative to the institution of new amateur regulations on January 1, 1929.

The only change that is being made in the amateur regulations is that provision relating to the frequency bands that may be used by amateurs in accordance with the International Radio Convention of 1927. A supply of the regulations including the new frequency bands is now being printed and copies will be forwarded to you as soon as available.

The Division does not propose to recall the outstanding amateur station licenses. However, the holders of amateur station licenses isued prior to January 1, 1929, will be furnished a copy of the new regulations in order that they may have before them the requirements as to the frequencies upon which their station may be operated.

Respectfully,
—W. D. TERRELL,
Chief Radio Division

"Blind" Flying

Medford, Oregon.

Editor *QST*:

The following is a report on an experiment performed on the Pacific Coast. There, as yet, no radio beacons are available for planes flying the mail and express routes from San Francisco to Seattle, and occasional difficulties in navigation occur over the mountains during storms and fog.

The thought came to the writer that, as the planes followed a direct route very similar to the telephone toll lines, it might be possible to follow them in some manner. It developed that there was a "pilot channel" of 24.3 kc. in continuous operation and that amplifiers on the line were less than 200 miles apart insuring good strength to this channel. This "pilot channel" is a sine wave current of, in this case, 24.3 kc. and harmonics are used to demodulate suppressed carrier telephone currents.

A T. R. F. set was built and pre-tuned to 24.3 kc. The detector was an autodyne and gave a note of about 1,000 cycles. It was found that on the ground the pilot channel could be picked up as evidenced by the 1,000 cycle note within a mile of the line on either side when using a small untuned aerial and no ground. The same results held true for plane operation and the presence of the plane within ¾ mile of the toll line in either direction could be detected.

The advantage of this arrangement seems to be that there is no spreading of the wave as noticed in radio beacons, the carrier or "pilot channel" is there free of charge, though the frequency may change for different routes, the frequency is far enough removed from that of power lines so that no interefrence is had, the frequency is far removed from the natural electrical disturbances set up by the ignition system of the plane, and no interference was had from high power commercials. In going over the mountains naturally the telephone toll lines also go over the top allowing the plane to still hear the signal with plenty of flying room beneath.

The disadvantage is that there is no way of telling whether you are to the right or left of the toll line except by changing course and listening for an increase or decrease in signal strength. North and south (the direction in which the line runs) cannot be differentiated. These suggestions are offered in the hope that their practical application may help in navigating planes when they must fly behind.

—L. Dow Inskeep, M. D

W2UO

Knoxville Amateur Radio Club,
Knoxville, Tenn.

Editor, *QST*:

It is indeed with pleasure that we note the outcome of your efforts to have the station of the Times, W2UO, removed from the amateur band it formerly occupied.

The Times, in common with a good many others, was never entitled to a position in our bands and the Radio Commission merely

THERMO-COUPLE TYPE INSTRUMENTS MODEL 425

INSTRUMENTS of this type, originated and developed by the Weston Company, are universally employed for measuring both high and low frequency currents. Their use has extended with the wide application of radio frequency into a great number of fields of experimental engineering and commercial activity. Incomparable in their refinements of mechanical and electrical design and unusually accurate and dependable in performance for such small instruments, the Weston Miniature Meters—Thermo-Couple types as well as A. C. and D. C. models—are everywhere accepted as the highest standards for radio testing service.

Thermo-Couple Types

Made as Thermo-Ammeters, Thermo-Milliammeters, and Thermo-Galvanometers or Current Squared Meters



For Panel Mounting

Flush Type—2" and 3¼" diameter. Furnished in metal or bakelite cases. Portable mounting bases also supplied.

The Weston Thermo-Couple Type Ammeter is furnished in ranges from one to 20 amperes having a safe overload capacity of 50%. It solves perfectly the problem of measuring high frequency currents such as are imparted to the antennae. Equally accurate for low frequency measurements and gives satisfactory service for D. C. measurements as well as A. C.

Milliammeters are furnished in three sizes—125, 250 and 500 ma. They give definite assurance of the output and accurate readings after hours of constant service. Extra large overloads will not burn out these meters. They are ideal for short wave transmission as they have a very low internal electrostatic capacity. For this reason they give the true value of the current in the circuit and do not disturb the constants in a transmitter.

Write for Circular J.

WESTON ELECTRICAL INSTRUMENT CORPORATION
602 FRELINGHUYSEN AVENUE - NEWARK, N.J.

WESTON
RADIO
INSTRUMENTS



Since any radio, old or new, is only just as good as the tubes in its sockets, it is clear how vital a point perfectly balanced tubes are.

The brand of radio tube is just as important as the "make" of the set.

Insist on

Cunningham
RADIO TUBES

For Clear Reception

righted a wrong when their license was revoked.

Your position has been most proper and may your efforts continue until our meager bands are entirely clear of every station except the legitimate amateur.

Knoxville Amateur Radio Club.
J. B. Witt, Secy.

The Total-Loss Receiver

1287 Castle Hill Ave.,
Bronx, New York City.

Editor *QST*:

Colonel Foster knows something good when he hears it. The other amateurs not so close to your domicile, to be sure, know the good things when they see them. My vote of thanks to Mr. Ross A. Hull for the highly interesting and descriptive article in the November issue of *QST* on 1929 receivers—a most timely contribution to the art and a New Year's present to the hams.

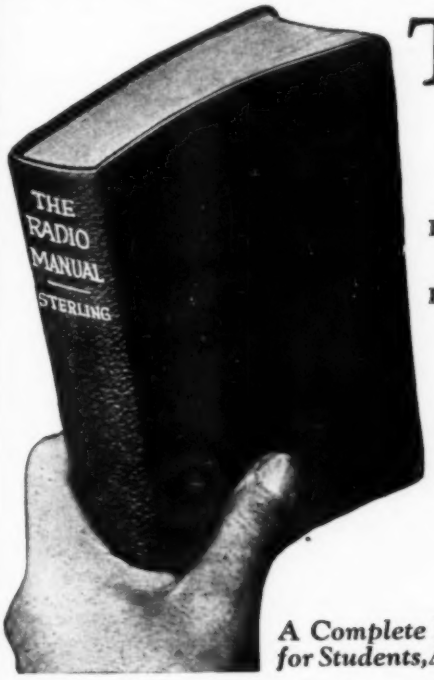
W6HM says that aluminum for the panel is the bunk, admittedly its cutting and trimming is hard work. However, friend Ross must have polished the panel of the four tuber too high, because that's what caught my eye. So once again, the chips flew here and soon the four-tube masterpiece was realized. I was at once amazed by its wonderful performance. I found it to be in a class by itself as far as receivers go, for it succesfully copes with New York City's air inferno, knocking Old Man Static and other parasitic noises into their rightful abodes and allowing the sounds most delightful to the ham to pour forth in abundance from all too small diaphragms.

However, a rude awakening from Paradise was the order and it took the few words suggested in the same article (relative to pressing the midget tuning condensers into the jacks by using the fingers) to bring this about. It was shocking to me. One hundred volts plus on the condenser is quite ticklish. The stator is fed from the positive 135 volt side and the rotor is on the grounded negative side. Would not a pair of rubber gloves tested at about 3000 or 5000 volts be a desirable part of every operator's equipment? Why fool around with chances of permanent injury or death? You can get all the dead hams you want in Swift's.

The tuned impedance as I have it, is plug-in also. This is a departure from the plans laid out in Mr. Hull's article, for his inductance secondary of the Ford Coil is attached to the set's baseboard in semi-permanent fashion and is not easily accessible. A second stage audio frequency amplyfying transformer is also mounted plug-in style and can be substituted very easily when phone reception is desired. In this way various tuned impedances and transformers could be arranged plug-in fashion and used to fit any necessary requirements.

Filling in the heads of countersunk screws with solder and sandpapering same flush with the aluminum panel gives the

Here's the answer to every question about the principles, methods, or apparatus, of radio transmitting and receiving--



THE RADIO MANUAL

By G. E. STERLING, Radio Inspector and Examining Officer, Radio Division, U.S. Dept. of Commerce.

Edited by ROBERT S. KRUSE, for five years Technical Editor of QST.

The new procedure adopted by the International Radio Telegraphic Convention is effective January 1st, 1929. THE RADIO MANUAL records it completely. Department of Commerce examinations for operator licenses are changed the first of the year. Only THE RADIO MANUAL presents all the material to meet the requirements of the questions. Progress has been steadily made in perfecting radio theory and practise. THE RADIO MANUAL, since it is the most up-to-date volume on radio, is the surest source of complete and accurate information on all points.

A Complete Handbook of Principles, Methods, Apparatus for Students, Amateur and Commercial Operators, Inspectors

Complete Preparation for Government License. 16 Chapters Covering

1. Elementary Electricity and Magnetism
2. Motors and Generators
3. Storage Batteries and Charging Circuits
4. Theory and Application of the Vacuum Tube
5. Fundamental Circuits Employed in Vacuum Tube Transmitters
6. Modulating Systems Employed in Radio Broadcasting
7. Wavemeters, Piezo-Electric Oscillators, Wave Traps and Field Strength Measuring Apparatus
8. Marine Vacuum Tube Transmitters including detailed description of Model ET-3626
9. Radio Broadcasting Equipment including, for the first time in any text book, the complete equipment of Western Electric 5 Kilowatt broadcasting Transmitter used in over 75% of American broadcasting stations
10. Arc Transmitters including description of Federal Marine 2 Kilowatt Arc Transmitter Type AM 4151; also models "K" and "Q"
11. Spark Transmitters including description of Navy Standard 2 Kilowatt Transmitter
12. Commercial Radio Receivers and Associated Apparatus including, for first time in any text book description and circuit diagram of Western Electric Superheterodyne Receiver Type 6004C
13. Marine and Aircraft Radio Beacons and Direction Finders
14. The Development of Amateur Short Wave Apparatus. Complete details of construction, operation and licenses
15. Radio Laws and Regulations of the U. S. and International Radio Telegraph Convention, Quotations of all important sections
16. Handling and Abstracting Traffic

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Never before has so complete a treatment of radio theory and operation been compressed into a single volume. Here is information that otherwise you could secure only by consulting many different books. And every detail is vouched for by authorities of the first rank. The Manual is profusely illustrated with photographs and diagrams. There are 700 pages, bound in flexible fabrikoid that is extremely durable. The immediate demand for so valuable a handbook has already nearly exhausted the second large edition. To be sure of receiving your copy without delay, order at once. The volume will be sent for free examination. Pay or return in 10 days.

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St and Number .....

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CONDENSERS



DUBILIER type 686 condensers have the usual Dubilier high safety factors for use in transmitter filter net works. 1000 volt DC rating.

May be connected in series where the working voltage exceeds 1000. Through series parallel connections practically any working voltage and capacity can be obtained.

DC voltage must not exceed 1000; or in A.C. supply filter circuits the transformer voltage must not exceed 750 volts per rectifier plate.

1 mfd. condenser $5.00
2 " " $8.00

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CONDENSER CORPORATION

DUBILIER Devices Reg. U.S. Pat. Off.

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New York City

panel a wonderful appearance. I did not use the shock absorbing, non-microphonic sockets on the r. f. tube or tuning coil. The sockets were solid construction, sturdy enough to allow the tuning coils to be withdrawn and inserted with ease. The r. f. tube seemed to set up an audio howl when inserted in the shock absorbing type of socket. This phenomena disappeared when a solid socket was substituted.

Surely the sets outlined in Mr. Hull's article, and supplemented by friend W6HM, rule the ham waves.

Burton Synnott, W2FF, W2BBX
O. R. S., O. B. S.

Portable Station Licences

209 Pine Ave., Room 410,
Long Beach, Calif.

Editor *QST*:

Over a period of time, I have noticed that several of the amateurs use their own call wherever they go; in other words, they have been considering them as portable licenses.

Wherever possible, I have been telling them about the fact that their license carries a certain address and if they wish to use a portable license, they should write in and get a portable license, as they are available.

Innocently, they think that no harm is being done, but it may be well to warn amateurs that their station license must be used only at the address that is indicated on the license.

—Don C. Wallace, W6AM

For Those Enjoying Brass-Pounding

Missouri Pacific Railroad Co.,
St. Louis, Mo.

Editor *QST*:

RCD UR LTR 2DA WI NT DA OR MO ABT WHY MI CK FR QST NT RCD - TNX FR UR LTR - PSE NO IM NT A BP ES LTR NRS QST HV ABT NIL XCPT LW WV OR HI FREQ OM ES HAM ACCTS - HV NT TM OR NTRST IN T SILY OM CY ES HAR IN LTR NRS QST - HV BN NTRST GNL RDO NWS ES TNCL DVLMT WI WCH QST HV HD GUD ES IMPT PRT IN YRS GN BI - HV NT ANI DSIR TO B BP ES NM TM FR IT EVN HD I T DSIR - SO WI BST WSHS FR VY HPY NWYER -

IM URS VY TLY

W. J. Burton,
Assistant to Chief Engineer.

P. S.: If the above seems amateurish or causes you any unnecessary effort and perhaps mild disgust, you will know exactly how I feel with a copy of *QST*. But for those enjoying brass pounding I have no criticism.

SM

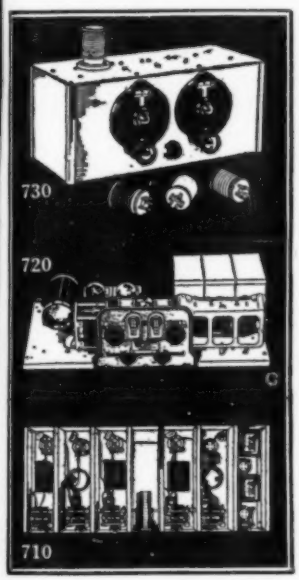
Here's 750 Volts Pure D. C. for S. W. Transmission

SEVEN hundred and fifty volts D. C.—perfectly rectified and filtered, free from hum and suitable for plate supply for transmission or for reception—is made available at low cost by the new S-M 324 power transformer. A big, husky sixteen-pound transformer. Two 750-volt, 150-milliampere secondaries (centre-tapped 1500-volt winding), used with two 281 type rectifier tubes, will supply up to 150 milliamperes at over 700 volts. Price, $25.00.



For use as filter choke in such a rectifier, the S-M 331 Unichoke is absolutely ideal. It utilizes the Clough resonance principle (under which it is licensed) to eliminate effectively the 120-cycle ripple—doing this more effectively with only 7 mfd. of condenser than do ordinary chokes with 8 to 12 mfd. Inductance at 110 milliamperes load, primary 2 henries, secondary 30 henries. Price, mounted in standard S-M case, $8.00; open mounted (331-U) $7.00.

Issue No. 7 of "The Radiobuilder" gives details of a circuit especially designed for economical production of pure D. C. at 750 volts. There are a few copies left—send for one right away if you haven't it.



730 Round-the-World Four

The famous "Thrill Band" set—for long-distance broadcast reception; has S-M Clough-audio-system tone quality—splendid also for code. One screen-grid r.f. stage, regenerative (non-radiating) detector. Coils in kit tune from 17.4 to 204 meters; S-M 131X Coil ($1.25) extends range to 350 meters, and 131Y coil ($1.50) to 650 meters. Aluminum shielding cabinet included with 730 KIT $51, or fully WIRED $66. Also with 731 Adapter (plugs into any receiver, converting it to short wave) KIT $36, WIRED $46. 732 Essential Kit, $16.50.

720 Screen Grid Six

Three screen-grid tubes in the r.f. stages, with shielded S-M coils, bring in distant stations on the next 10 kc. channel to powerful locals! New S-M standard of tone quality. Custom-built complete in 700 cabinet, $102.00; complete KIT, with pierced metal chassis and antique brass escutcheon but without cabinet, $72.50.

710 Sargent-Rayment Seven

Four screen-grid r.f. stages—a station on every 10-kilocycle channel right around its single-control dial (with five auxiliary vernier knobs)—equipped with the unequalled S-M Clough system audio amplifier—yet the 710 is only $175 custom-built complete, or $130 for KIT including aluminum cabinet.

New S-M Clough-System Push-Pull Transformers

Built on the Clough System, with curves flat from below 50 cycles to well above 5000—these transformers give to "push-pull" a new and really startling significance. And their prices, like their quality, are unbeatable!

257 Push-Pull Input Transformer, to operate from one amplifier tube into two 171A, 210, or 250 tubes. Price.....$7.00

227 Push-Pull Interstage Transformer, to feed from two 112, 226, or 227 tubes into two 112A, 226, 227 or 171A, 210 or 250 tubes.....$8.00

258 Tapped Output Impedance, to feed from two 171A tubes into any standard speakers.....$5.00

248 Universal Output Choke, to feed out of two 210 or 250 tubes into one to six or more standard speakers; provided with several impedance-matching taps. It will handle over 20 watts without core saturation. Open-mounted.....$7.00

228 (248 in case like 227).....$8.00

Remember—S-M guarantees these push-pull transformers to have a finer frequency characteristic than any and all competitive types—bar none.

Are you getting The RADIOBUILDER regularly? No. 9 (Jan. 1929) describes new push-pull circuits, utilizing the new type of push-pull transformers described above. No. 7 (Nov. 1928) described in detail, with complete circuits, a 750-volt rectifying system using the new S-M 324 transformer illustrated above. Copies of both of these issues may be had without charge by QST readers as long as they last; use the coupon.

If you build professionally, by all means ask for information on the S-M Authorized Service Station proposition; its money-making opportunities are greater than ever.

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That Boosts Sales

The Jewell 199 A. C.—D. C. Set Analyzer solves the radio service problem perfectly. In conjunction with the Jewe Radio Set Analyzer Chart it enables service men to check radio receivers scientifically, thus getting the best possible results out of every receiver. Nothing is left to guesswork.

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Write for literature describing the Jewell Pattern 199 Set Analyzer and other high grade radio instruments.

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I. A. R. U. News

(Continued from page 52)

BELGIUM

The section was created on September 19, 1925, and on April 28, 1927 The Reseau Belge was recognized as the National Section. The President of the R.B. is Mr. Paul de Neck, 312 Rue Royale, Brussels.

BRAZIL

The section was organized on September 15, 1925. No national society has yet been recognized, but this will probably be done within a few months. Mr. Vasco Abreu, Riachuelo 80 C-4, Rio de Janeiro, is the president.

CANADA

The Canadian Section came into existence at the formation of the Union in Paris, on April 17, 1925, and, as provided by the Constitution, consists of the Canadian Section of the American Radio Relay League, with the Canadian General Manager, Mr. A. H. K. Russell, as the president.



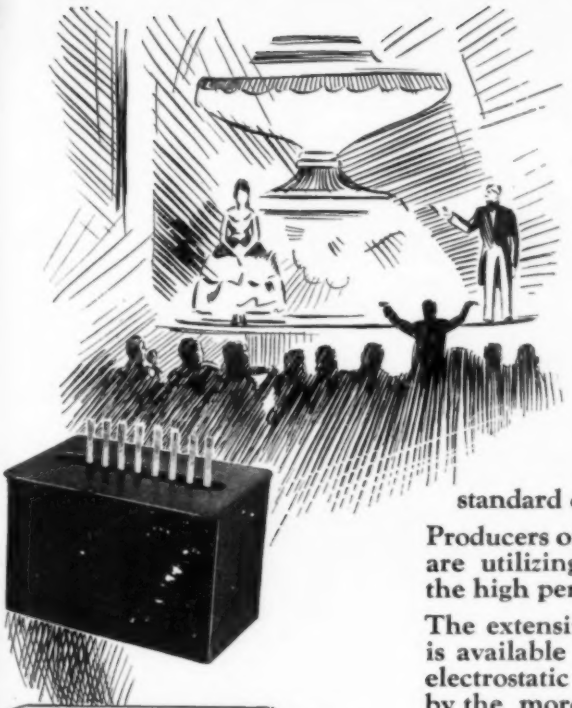
THE TRAINING SHIP "L'AVENIR"

FRANCE

The French Section was also organized at the formation of the Union, on April 17, 1925. A national society, the Reseau Emetteurs Francais, grew out of the national section, and since June 20, 1925 has been the national section under the name of the R.E. F. The President of the R.E.F. is Mons. Reyt, Professeur au Lycee, 24 Rue des Vaupulents, Orleans.

GERMANY

The German Section was formed September 15, 1925. On September 1, 1927, the D.A.S.D. was formally recognized as the national society to take over the national



Faradon— an important factor

Faradon quality and dependability have contributed in no small measure to the present high standard of radio reception and transmission.

Producers of quality equipment recognizing this are utilizing Faradon Capacitors in achieving the high performance standard required.

The extensive experience of Faradon engineers is available to assist in taking care of special electrostatic condenser requirements not covered by the more than 200 types of Faradon Capacitors in regular production.

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Established 1907



Faradon

Electrostatic Condensers for All Purposes

2500



"Isn't it about time, Dad, you eliminated the adenoids"

ANY set with inferior transformers has adenoids. Why not have your set give you what it is capable of—it's a mighty simple thing to eliminate the adenoids from your set—and to substitute true tones as given by AmerTran radio products.

No matter what your set is you have yet to hear the music as it is broadcast from the studio with all of the overtones and shadings from the lowest stop on the organ to the piercing note of the piccola.

AmerTran audio systems will give you every tone broadcast—just as it is broadcast from the studio. A pair of De-Luxe transformers, or the superb power amplifier (push-pull for 210 tubes) and the ABC Hi-Power Box. No matter what AmerTran audio system you choose, your set will be free from adenoids. See your dealer or write to us.



AmerTran ABC Hi-Power Box—500 volts DC plate voltage, current up to 110 ma; AC filament current for all tubes for any set. Adjustable bias voltages for all tubes. Price, east of Rockies—less tubes—$95.00.

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Builders of Transformers for more than 29 years

41 EMMET ST. NEWARK, N. J.

section. Herrn Oberst a. D. Otto Fulda, Blumenthalstr. 19, Berlin W. 57, is the present president.

GREAT BRITAIN

The British Section was formed at the Paris Conference, April 17, 1925. It eventually merged with the T. & R. Section of the Radio Society of Great Britain, and finally on December 14, 1927, the R.S.G.B. itself was recognized as the national section.

The president of the R.S.G.B. is Capt. Ian Fraser, 53 Victoria St., London, S. W. 1.

NETHERLANDS

The Dutch Section of the Union was formed on September 23, 1925. Out of this section grew a national amateur society, the N.V.I.R., and this took over the section in January, 1928. Mr. R. Tappenbeck, Hoogduin, Noordwijk-aan-Zee, is the President.

ITALY

This section was formally organized on March 4, 1926. In January, 1928, the A.R.I. was organized as the national section. Union matters in the A.R.I. are handled by a committee of three, consisting of Messrs. Gnesutta, Montu and Pugliese. Correspondence should be addressed to Mr. Pugliese, the Secretary, at via Borgonuovo 21, Milano, 2.

SOUTH AFRICA

Organization of the Union in South Africa was completed April 29, 1927, and on August 5, 1927, the South African Radio Relay League was recognized as the national section. The President is Mr. Joseph White, P. O. Box 7007, Johannesburg.

SPAIN

The Spanish section came into being on July 3, 1925. Here, as in France, the ing on July 3, 1925. Here, as in France, the section later became a national amateur organization, and took the name of the E.A.R. Association. Final action recognizing the E.A.R. Association as the national society was taken on October 14, 1926. The President is Mr. Miguel Moya, Mejia Lequerica 4, Madrid.

SWITZERLAND

The Swiss Section was formed September 10, 1925, but has never voted on the matter of designating some national amateur society as the national section. Due to heavy restrictions in Switzerland it is doubtful if any such national society exists to be recognized.

The President of the Section is Dr. Walter Merz, Chateau de Bumplitz, Berne.

UNITED STATES

The United States Section was created at the Paris Conference, April 17, 1925, and under the terms of the original Constitution it was specified that the American Radio Relay League, Inc., should constitute the national section for the U.S. The President of the A.R.R.L is Mr. H. P. Maxim, 1711 Park St., Hartford, Conn.

Stop "FOOLING" with RADIO!







RADIO amateurs! Don't treat radio as a mere plaything! Make it pay you real money. Thousands of fellows are doing it. So can you. A little commercial training is all you need to give you money-earning confidence and ability. Get this training in spare time at home . . . through the marvelous home-laboratory course sponsored by the Radio Corporation of America. The FREE Radio Book tells all about it.

If you've been playing around with radios and have a pretty fair knowledge of it, you can now easily and quickly lift yourself into the real money class. For a marvelous new home-laboratory course in Radio gives you just the added commercial training you need for big-time radio success. As a result of this course many men formerly in poorly paid positions are now earning as high as $100 to $250 a week in Radio work!

Home-Laboratory Training

With this advanced commercial training you get the "how" as well as the "why" of every phase of radio work and technique. Only an hour or so a day—in spare time—is all you need to put the finishing touch to your radio experience. As part of your course, you receive absolutely free of extra charge—an outlay of fine apparatus.

Training backed by the Radio Corporation of America

Our graduates are in big demand everywhere. They enjoy greater success because they're posted right-up-to-the-minute in *everything* in Radio. Radio's progress each year is measured by the accomplishments of the great engineers at work in the research laboratories of the Radio Corporation of America. This Radio organization sets the standard for the industry, and because it sponsors every lesson in the course you are assured of the most complete authoritative and up-to-date radio training in the world!

Money Back If Not Satisfied

The lessons prepare you for success in all phases of radio—manufacturing, servicing, selling, ship and shore broadcasting, Television, Photoradiograms, and radio equipment. A signed and sealed agreement assures you of complete satisfaction upon completion of the training—or your money will be promptly refunded! So you cannot lose a single penny!

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It tells you all you'd like to know about Radio. Its 50 pages and photos describe Radio's opportunities for adventure and success. It describes in detail the famous training that has enabled us to place thousands of our students in fine commercial positions, usually from 3 to 10 days after graduation! Read this great book . . . it may mean the turning point in your life! Mail the coupon now—the book is absolutely free! RADIO INSTITUTE OF AMERICA, Dept. ST-2, 326 Broadway, New York, N. Y.

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Gentlemen:

Please send me your big FREE 50-page book which tells about the opportunities in Radio and about your laboratory-method of guaranteed radio instruction.

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RADIO manufacturers, set builders and experimenters demand reliable resistors for grid leaks and plate coupling resistors. For such applications Bradleyunit-B has demonstrated its superiority under all tests, because:

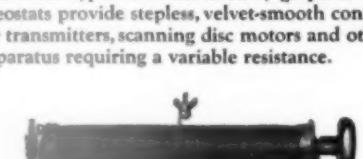
1—*Resistance values are constant irrespective of voltage drop across resistors. Distortion is thus avoided*
2—*Absolutely noiseless*
3—*No aging after long use*
4—*Adequate current capacity*
5—*Rugged, solid-molded construction*
6—*Easily soldered*

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Radiostat

This remarkable graphite compression rheostat, and other types of Allen-Bradley graphite disc rheostats provide stepless, velvet-smooth control for transmitters, scanning disc motors and other apparatus requiring a variable resistance.



Laboratory Rheostat

Type E-2910 — for general laboratory service. Capacity 200 watts. Maximum current 40 amperes. A handy rheostat for any laboratory.

Write for Bulletins!

ALLEN-BRADLEY CO., 277 Greenfield Ave., Milwaukee, Wis.

Allen-Bradley Resistors

In previous issues of this magazine we have referred to the signals of XEB4WK, the Belgian training ship "L'Avenir." Through the courtesy of the Reseau Belge we are able to print the following extremely interesting photos and description of this all-amateur installation.

XEB4WK

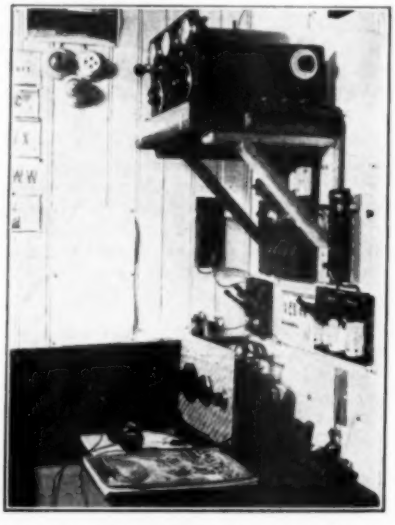
By EB4WW

L'AVENIR", or XEB4WK, is a large four-masted sailing training ship, one of the finest of her kind afloat. On each trip she carries, in addition to cargo, about 70 midshipmen who are learning how to become licensed marine officers for the mercantile shipping board in Belgium. It might be pointed out that there is no auxiliary power of any kind, sails alone being used for propulsion.

EB4FT and myself thought it would be interesting to put on board an experimental amateur set, and after obtaining the necessary permission we designed, and installed the transmitter and receiver shown in the photograph. The set was built by Mr. Velghe.

The first circuit tried out was a Mesny (push-pull) two-tube, but it resulted in too much QSSS with all that maze of wire stays and halyards only several feet from the antenna. It was almost impossible to read when the wind was blowing.

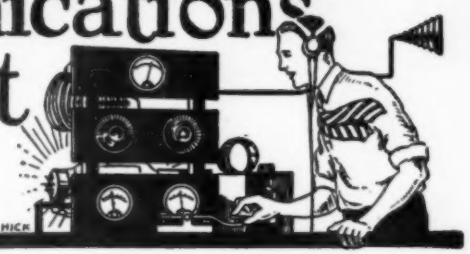
The cure was a M.O.P.A. circuit, which after some changes emerged as shown in



THE OPERATING ROOM AT XEB4WK

the circuit diagram. Best results were secured with a very small coupling capacity direct to the oscillator plate. The capacity used to balance the amplifier was quite critical in adjustment. Grid bias for the amplifier would have been very useful, but since the set is battery operated, could not

The Communications Department



F. E. Handy, Communications Manager
L. R. Huber, Asst. to Coms. Mgr.
1711 Park St., Hartford, Conn.

Amateur Accomplishment

An Example of Typical Amateur Spirit

MR. Burt H. Taylor (W1KB) of Haverhill, Massachusetts has for several months been working operator Wyman of nn7NIC with the Marines in Nicaraugua, handling traffic from the remote post at Managua to many relatives of the Marines living in the New England states.

In late December he received an unusual call for assistance—assented to do his best to establish adequate Nicarauguan contact by amateur radio (in spite of the fact that no schedules were in effect)—and as a result he was able to accomplish an intimate personal service that could not have been handled as effectively by *any* other communication agency. Such work as he was able to do reflects credit not only to the operators concerned but also to the A.R.R.L. and to amateurs as a class. It is regrettable that in many like incidents no report of the work accomplished reaches Headquarters.

The mother of three boys, all Marines in Nicaraugua, was taken seriously ill on December 28 and rushed to the hospital. As soon as it was suspected that she could not survive an operation she immediately desired to get in touch with her sons. At first the boys could not be located. After trying different means of getting in touch with them, even appealing to Congressman Andrews through others, W1KB was called and asked to assist. On the first QSO with nn7NIC, operator Wyman left his station and attempted to find these particular Marines, but they were miles away, at Leon, Nic. However, an urgent message was put through and nn7NIC's operator promised to do his best to have at least one of the boys on hand for a schedule the following night.

The next evening contact was re-established on schedule. The operator in Nicaraugua had kept his promise. The doctor's statement and the family's message were transmitted to the sons and the boys prepared a message for their sick mother. nn7NIC stood by while this was phoned to the hospital. The mother was told as she lay on her cot. She understood, and smiled—and W1KB returned the answer.

Further contacts were made on the following days and until it was necessary to report the mother's death. The boys in the Marines were happier by knowing that their mother got their word with no delays and that she understood perfectly before she died. The Marines informed Taylor and Wyman that they never would forget the unusual service the operators had performed.

This spendid and reliable communication work was accomplished with a single UX210 in a transmitter having about 600 volts from two 281 rectifier tubes as a plate supply source—a typical amateur station. The outfit had been adjusted with a monitor (a la *QST*) and was reported by nn7NIC as "R6-7 pure d. c." Taylor did his best to put the word through and get an answer. He did his work carefully and well. Fifteen minutes after the boys had filed their word with nn7NIC they knew that it had been transmitted in time and was successfully understood. Much credit should likewise be given operator Wyman of nn1NIC who did a splendid job each night through the QRM on the 7000 kc. band.

Neither operator expected any praise or glory from the undertaking. Both operators deserve congratulations on their accomplishment. It is this spirit of attempting the difficult and accomplishing the impossible in the face of obstacles, all with ordinary equipment and no hope or expectation of reward of any kind, that we like to think of as the typical attitude of amateurs and A.R.R.L. members in attempting worthwhile things. Such work of course brings thanks from those who appreciate personal and unselfish service. It also brings the warm glow that comes from knowledge of a job well done. These things are often more to be desired than the tinsel and pretense of more practical compensation which amateurs cannot accept and do not want. It is this love of unselfish accomplishment, together with the ability to do worthwhile things that makes our hobby so full of zest.

Marker Stations

Accurate "landmarks" are useful in this day and age requiring a high degree of frequency precision in all high-frequency work. Stations operating for many hours daily and located close to our amateur frequency allocations can and should be used often and regularly in locating our bands and assisting in determining our individual operating frequencies in those bands. While at some later date there may be additional accurate "marker stations" close to our territory, there are already several such stations transmitting that may be depended upon. We understand that WIY, WIZ, and WEB are maintaining a very high degree of frequency precision according to daily measurements. The frequencies given below for these stations are highly accurate, and therefore useful in calibrating monitors, frequency meters and the like. The channels assigned WEM and NAA are also given and these stations are believed to be maintaining these frequencies quite accurately, although we have no information on recent checks made on these latter stations.

WIY	13,867.	kc.
WIZ	6,965.3	kc.
WEB	6,933.6	kc.
WEM	7,400.	kc.
NAA	4,015.	kc.

1929 Q Code and Abbreviations—Use 'em

THE changing of old operating habits, which have become established is a difficult and somewhat painful task. The effort is comparable to that required in changing our habit of dating letters in the old year which always persists for a short time after January first. Some confusion and embarrassment is to be expected during the period of changing over to the new system, especially where the new and the old Q signals have conflicting meanings. This has been observed already in some cases which are as amusing to the observer as they are embarrassing and confusing to those amateurs who have been negligent in reading *QST* and who are suddenly caught using obsolete abbreviations or are otherwise "behind the times." Fortunately, like the letter-dating business, this state of affairs improves with time and practise and by the time this issue of *QST* appears, conditions are bound to have changed for the better. Those who have been negligent in memorizing or are caught without a copy of the R. & R. or a list of Q signals at hand in mid-February will have some reason to feel old fashioned and out of date when someone alive to the situation uses the correct procedure in the course of a snappy two-way contact.

We have no argument with the chap who has constructive criticism of the list of Q Code or other abbreviations. There is no human institution that is letter-perfect and cannot be improved by constructive suggestions. Any necessary alterations in procedure or international abbreviations can and will be made

by the proper authorities all in good time, when operating experience with these usages indicates the nature of improvements which would be most desirable.

The principal and important thing to remember at present is that only by *universal recognition and use* of internationally established abbreviations and procedure can there exist a full measure of understanding in the course of communication work. Immediate and universal use of the new Q Code and other international abbreviations, is necessary to avoid confusion. Information on the new audibility code, Q code and other abbreviations is still available in convenient form for station reference in the Rules and Regulations of the Communications Department which will be mailed anywhere on receipt of a postal requesting same. Where necessary, amateurs are requested to abandon the old meanings and use the new, remembering that "QST" and "QRR", now blanks in the international Q Code, are retained with special meanings adopted by the A.R.R.L. for only amateur use.

Just the other night, we heard a prominent station in communication with another well-known station following a "general" call. Other stations had answered the call and were heard but not identified at once; which quite properly led the first station to use "QRZ". The second station apparently was not as familiar with the new procedure and got quite flustered, coming back with, "Who, me??" as a result. Of course, the matter was straightened out as soon as the 1929 abbreviation, QRZ, had been explained.

QRZ? By whom am I being called?
QRZ You are being called by . . .

We also heard a station ask quite confidently for "my QRH" the other night, in reply to which he got the "QRG" which he should have asked for in the first place. To make the point clear, we are giving the correct meanings of these abbreviations in full here, also.

QRG? Will you indicate to me *my* exact frequency in kilocycles (or wavelength in meters)?
QRG *Your* frequency is . . . . . kc. (wavelength is . . . . . meters)
QRH? What is *your* exact frequency in kilocycles (wavelength in meters)?
QRH *My* exact frequency is . . . . . kc. (wavelength is . . . meters)

Another example of what *not* to do occurred when a station having reception difficulties sent "QRV" requesting a series of test letters so adjustments could be perfected. The station having traffic at once started to send its traffic and succeeded in wasting quite a bit of valuable time before it could be straightened out.

QRV? Must I send a series of V's?
QRV Send a series of V's.

Then there is the chap who asked "QRL?" and was greeted by a report on his signals instead of a reply.

QRL? Are you busy?
QRL I am busy (or, busy with . . . .). Please do not interfere.

All these are actually examples of mistakes that have been observed in the course of early 1929 operating, not to mention the "whats" and "hows" that have followed the first use of QRJ? QSX? QSP? QRI? QSK and the like in 1929. If there are any of these Q's that are still unfamiliar, they should be memorized today, as these meanings are needed in our everyday amateur work. The miscellaneous abbreviations, particularly those used in getting repeats, should be studied, also, as they are very valuable. *Use them often* and very soon they will be established as time "saving" abbreviations.

To increase familiarity with those abbreviations which are best adapted to our amateur needs, we are listing a number of additional meanings in addition to those that have been discussed already. Of course, it is unnecessary to mention those parts of the Q code with which all are at present familiar. QRM, QRN, QRO, QRP, QRQ, QRS, QRT, QRK, QSL, QSO and QRX remaining unchanged in meaning and will be as useful as ever.

The new audibility code recognizes the principle that it is "readability" that counts—that in all our operating, the comparison of "signal" with "background noises" or other interference is what determines the possibility of copying a signal which is, after all, the only thing which matters in communication work. The selectivity and sensitivity of the receiving equipment in addition to conditions play a part in determining whether communication is feasible. The quantitative "audibility", depending principally on the amount of amplification used, cannot be measured practically and means little when it is so measured due to the other factors, all of which leads us to the conclusion that the new QSA system is just what it should be in every respect.

QSA1 Hardly perceptable, unreadable.
QSA2 Weak, readable now and then.
QSA3 Fairly good, readable but with difficulty.
QSA4 Good, readable.
QSA5 Very good, perfectly readable.

The following appear to be especially useful in amateur work:

QRI? Is my tone bad?
QRI. Your tone is bad.
QRJ? Are you receiving me badly? Are my signals weak?
QRJ. I cannot receive you. Your signals are too weak.
QRW? Must I advise . . . that you are calling him.
QRW Please advise . . . . that I am calling him.
QSB? Does the strength of my signals vary?
QSB. The strength of your signals varies.
QSC? Do my signals disappear entirely at intervals?
QSC. Your signals disappear entirely at times.
QSD? Is my keying bad?
QSD. Your keying is bad . . . . . signals unreadable.
QSK? Must I suspend traffic? At what time will you call me again?
QSK. Suspend traffic. I will call you at . . . . .
QSP? Will you relay to . . . . .?
QSP. I will relay to . . . . .
QSW? Will you send on . . . . . meters (or on . . . . kilocycles) waves of Type A1, A2, A3 or B?
QSW. I will send on . . . . . meters (or on . . . . . kilocycles) waves of Type A1, A2, A3 or B. Continue to listen.
QSX? Does my frequency vary?
QSX. Your frequency varies.
QSY? Must I send on . . . . kilocycles without changing the type of wave?
QSY. Send on . . . . . kc. without changing type of wave.
QTA? Must I cancel nr . . . . . as if it had not been sent?
QTA. Cancel nr . . . . . as if it had not been sent.
QTB? Do you agree with my word count?
QTB. I do not agree with your word count; I shall repeat the first letter of each word and the first figure of each number.
QTC? How many telegrams have you to send?
QTC. I have . . . . telegrams for you or for . . . .
QTR? What is the exact time?
QTR. The time is . . . . . .

?AA . . . ,	repeat all after . . . . .
?AB . . . ,	repeat all before . . . . .
?AL	repeat all that has been sent
?NB . . AND	repeat all between . . . . and . . . .
?WA . . . ,	repeat the word after . . . . .
?WB . . . ,	repeat the word before . . . . .
?PBL,	repeat the preamble
?ADR ,	repeat the address
?TXT ,	repeat the text
?SIG,	repeat the signature
?CS	repeat the call signal
CL	I am closing my station
C	Yes (correct)
N	No
UA	Are we in agreement (you agree?)
RPT	Repeat (or, I repeat)
GA	Resume sending (go ahead)
OK	We are in agreement

A New Abbreviation—"MK?"

Several operators have sent us suggestions in letters and radiograms calling attention to what seems to be an important omission in the international lists of Q Code and Miscellaneous Abbreviations. It appears that a new abbreviation must be coined to suit the requirements of our message-handling fraternity. Since QRV has been changed to refer to the sending of a series of V's for testing purpose there appears to be no good abbreviation meaning "are you ready". At least a search of both the miscellaneous list and the Q Code does not disclose such a meaning. W9CNP and W9DLD have favored us with the suggestion of an added Q signal to carry this same meaning. However, we hesitate to look for any more blanks in the international Q Code. The

new meanings in this list are fairly numerous and we shudder to think of further additions, even of a non-official variety. Frankly, we don't believe more Q's should be added to the already over-long list which must be memorized. There are other reasons, too, which indicate that more Q's would be in bad taste in addition to the likelihood of confusion resulting from such an addition.

R. P. Griffith of W9EJQ comes to our rescue at this juncture suggesting a short, snappy, two-letter abbreviation which will sound well in traffic handling and which carries a logical meaning. He proposes:

MK? Are you ready to receive messages?

MK I am ready. Go ahead with messages.

The meaning suggests itself, M standing for "messages" and K the usual "go ahead" signal. W9EJQ points out that the fact that these letters appear in the call signal of our Headquarters' station has no significance, since any two-letter combination will be a part of someones call signal. The coincidence may be useful to some in remembering the abbreviation. At any rate everyone thus far approached for a comment on the idea has approved without qualification. It remains only to put the new abbreviation into use ,to stand or fall by its suitability and usefulness as has been the case with other similar amateur usages. There is no question about the need for an abbreviation with this meaning. Use "MK" and let us know how you like it.

VOLUNTEERS WANTED!!

WITH ALL the material that has been presented in recent issues of *QST* it should not be very hard for beginners to build receivers for operation in the 1750 kc. (150-meter) band. Once they do this, however, they need something to copy in order to improve their code speed. Thus it is that we need volunteer transmitting stations in the "high" band.

Radiophone stations are preferred, as it is possible to instruct much more efficiently through the microphone than only with a key. A dozen or so of such volunteers are on the air now (see schedules in the October and succeeding issues of *QST*, but we need more.

If you have a 1750 kc. radiophone and care to engage in this most worth-while work, please drop us a line giving data on your exact frequency, hours of schedule, etc. We have some mimeographed material which will aid in putting the instruction on the air.

BEGINNERS ATTENTION!

Those of you who are still learning the code should remember that you should not only listen to the broadcasts sent out by the volunteers, but that you should, also, get a key-and-buzzer for yourselves and work with the Continental Code during your spare moments. In the *Radio Amateur's Handbook* there is ample instruction on how to go about this work. Every one of you should read this and be guided by it.

We have several new volunteers' schedules to list for those who are interested in receiving code practice. In each case the time given will be Standard Time for the locality of the station:

W1BDA, East Haven, Conn., broadcasts with phone and key on about 1715 kc. (175 meters), on the following schedule:

Sunday—3:00 to 4:00 p.m.
Monday—8:00 to 9:00 p.m.
Wednesday—8:00 to 9:00 p.m.
Friday—8:00 to 9:00 p.m.

W9AFP, Tabor, South Dakota, broadcasts with radiophone, using a UX210 oscillator and UX210 modulator and two-stage speech amplifier, in the L. C. Hartley circuit. His hours of schedule are 1:30 to 2:00 p.m. on Sundays; 7:30 to 8:00 p.m. on Mondays and Thursdays; and 10:30 to 11:00 p.m. on Tuesdays and Fridays. The frequency is somewhere in the 1750 kc. band.

W9FLS, Ava, Illinois, broadcasts with code transmission in the vicinity of 1760-1710 kc. (170-175 meters) on Tuesday, Thursday, Saturday, and Sunday at 10:20 p.m. The op at W9FLS is an old-timer who has been through railroad and Western Union service.

On Sundays W2GL will transmit from 9:30 to 10:30 am instead of as announced with other schedules in Jan. *QST*.

The following broadcast stations (speaking now of the BCL type) are understood to be broadcasting code lessons for the edification of the general public. Beginners are invited to listen for them on the *family's* radio set:

KFPY—Spokane, Washington
WJAS—Pittsburgh, Pa.
KFJB—Marshalltown, Iowa
KSCJ—Sioux City, Iowa
KWCR—Cedar Rapids, Iowa
KUOM—Missoula, Montana
KGEK—Yuma, Colorado
KGRS—Amarillo, Texas
KSAC—Manhattan, Kansas
WSIX—Springfield, Tenn.
WEAN—Providence, R. I.
WEEI—Boston, Mass.
KGER—Long Beach, Calif.
KMOX—St. Louis, Mo.
WAAM—Newark, N. J.
KFWC—Pomona, Calif.
WCAJ—Lincoln, Nebr.

W7ACB-W7OH, Seattle, Washington, will keep a schedule one day a week until requests for more schedules are received from beginners. Voice and I.C.W. will be used on 1735 kc. (173 meters) each Wednesday evening from 7:00 to 8:30 p.m. Beginners please note that W7ACB-W7OH transmissions depend on whether YOU let him know that you are listening.

It is hoped that following the U.S.A.-Canadian conference on short wave allocations to be held at Ottawa, that new arrangements for a special frequency for Canadian amateurs outside of that called for by the Washington Convention of 1927 can be made. The frequency may not be the same as formerly in any event, but quite possibly will be one of the high frequency allocations alloted by the conference to Canada.

Are your ready for the Governors-to-President Relay? This takes place on March third and fourth. The Washington Radio Club has arranged for a continuous watch on different bands at several stations during the relay. See full details elsewhere in this issue. Do your part in putting the messages through, please, OM. We hope the relay will be an enjoyable one for all who take part. It's up to us to see that *every message that starts is put through reliably and accurately* to the Washington gang who can be depended on to handle their end.

Answering the question brought up by a number of the beginners who desire to build amateur phone stations, voice transmissions may be carried on legally *only* in one of the following frequency bands, the first two of which are most popular with phone men.

1715-2000 kc. (150-175 meters)
3500-3550 kc. (84.5-85.7 meters)
56000-60000 kc. (5-5.36 meters)

Just to prove what is possible on 1750 kc. on even a "bad" or "off" night, W9MM sends in a list of the stations bagged on 1750 kc. "phone" in just two hours on such a night. W9MM is at Converse, Indiana. The list includes W3CV and W3RP (Maryland), W8DBQ (New York), W8DPD (West Virginia), W9EFT (Nebraska) and W9AHO (Kansas). All this in 1929, too.

S.C.M. Manual I. Felizardo (K1AU, 252 Galicia St., Manila, P.I.) has just returned from the States and is taking over the work as Section Manager, handled by Jiminez of K1AT in his absence. Mr. Felizardo desires to have reports of radio work from every amateur in the Philippines, to help him in putting the Philippine Section of the A.R.R.L. on the map. If you live in the Philippines please get in touch with OM Felizardo and tell him what you are doing so he can mention in his reports to *QST*. K1AU has resumed his schedule with W6BVY at Newman, Calif.

Have you heard XC51 on about 6895 kc. (43.5 meters)? It is the station of the Trens News Agency at Colon St. 43, Mexico City. Daily news broadcasts are given at 9 p.m. and midnight, Central Standard Time. The first one is in Spanish and the second one is in English. Each is preceded by a generous amount of "QSTing".

This will be pretty good practice for the Spanish students in our midst. XC51 will appreciate knowing that you copy the broadcast.

W2AA claims to have copied the following from a 600 meter station within 10,000 miles of Sandy Hook on New Year's morning:

"U. S. Weather Report Sandy Hook 8 a.m. barometer 30.11 rising steady falling temperature 38 wind east 12 steady backing veering sky overcast sea smooth moderate rough slight visibility one mile."

Did we all feel that way the morning after?

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Family ties were renewed via amateur radio recently when W1KH worked ef8BTR, thus allowing a mother in Boston to "talk" to her daughter in France for over an hour. FB, W1KH and ef8BTR!!

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One experimenter reports that he has a couple of 852 tubes which he uses "one at a time."—We wonder if they are used one on each half the cycle?

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W8ATUS says our "did you know" column slipped badly last month in failing to suggest the fact that 210-type tubes can be got "dirt cheap" at Kresge's chain of stores throughout the country. He goes on to report that the 210-type cost just $3.25—250 type tubes only $4.98!

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W8GE has a suggestion for A.R.R.L. phone men wishing to test their modulation effectively. He says that "ham" workers who can understandably transmit the following two sentences used for such tests by the Bell Telephone Laboratories can rest assured that their modulation is really good. Here are the sentences for testing the "voice" effectiveness of your station:

Joe took father's shoe bench out.
She was waiting at my lawn.

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We understand from Canadian General Manager Russell that Canadian amateur stations no longer have the special 5700 kc. (52.5 meter) frequency assignment. We shall expect to work an increasing number of our Canadian friends and brother amateurs on the regular amateur bands, however. It is expected that official reciprocal arrangements permitting important message-handling work by amateurs with expeditions and remote points will be concluded shortly by the governments of the United States and the Dominion of Canada.

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BRASS POUNDERS' LEAGUE

	Orig.	Deld.	Rel.	Total
W8CHC	863	221	792	1872
K1HR	569	84	550	1203
W6AMM	257	820	25	1102
W3ZF	52	83	727	862
W6IP	33	64	634	734
W6CHA	44	85	590	719
W9AYK	64	96	442	602
W6SR	509	18	50	577
W1MK	135	162	268	565
W9DLD	34	36	452	522
W9AIN	29	102	356	487
W9DGW	8	23	430	461
W9EJQ	31	31	374	436
W6ASJ	180	1	254	435
W6ALX	59	18	342	419
W9EDW	6	40	350	396
W2BGO	307	42	42	391
W3BBW	42	234	59	335
W9RR	152	63	112	327
W8CQN	82	4	236	322
W1BEA	118	75	127	320
W8BGY	49	18	244	311
W8DED	34	32	238	304
W8JA	58	17	226	301
W6BAM	23	42	228	293
W9ELX	39	11	242	292
W8DYH	237	26	27	290
W9COS	46	196	40	282
W9DAE	22	12	232	266
W2SC	26	36	202	264
W9DXZ	16	89	152	257
W9DEK	24	12	218	254
W1ANH	50	41	162	253
W1AFB	43	17	190	250
W1ACH	78	78	90	246
W8CMB	45	37	162	244
W9BPW	17	8	218	243
W3AKB	31	46	162	239
W2AVP	68	122	48	238
W1BIG	103	56	75	234
W6DVI	58	53	122	233
W6CGM	27	43	156	226
W8DJS	114	9	102	225
W9CET	67	38	116	221
W9EKW	42	27	148	217
W9DWN	4	10	199	213
W9CFN	29	43	140	212
K7ABE	54	52	104	210
W6ZBJ	14	4	192	210
W9EBO	65	17	122	204
W3CFG	16	14	174	204
W9EMU	18	11	172	201
W8CFL	21	38	141	200
W9FLG	71	59	60	190
W9BCA	20	60	109	189
W8AVK	25	51	100	176
W8AHC	24	72	72	168
W8RN	38	52	64	154
W9DI	8	68	74	150
W8DAQ	15	50	65	130
W1BOB	9	53	67	129
W1BLV	23	53	34	110
W2KR	22	67	21	110
W8CFR	48	54	2	104
W1KY	14	54	26	94
W6BZR	—	68	16	84
W7TX	17	63	2	82
W2APV	13	67	—	80

Again W8CHC tops the B.P.L. by handling over eighteen hundred messages during December. We understand that four reliable operators and a bunch of schedules account for this exceptional work. FB. K1HR and W6AMM handled well over the thousand mark, also Bruce Stone's *deliveries alone* constitute a record and W6AMM is to be congratulated on this score. The holiday traffic certainly was heavy and this is indicated in an unusual large B.P.L. crediting many reliable and well known stations.

All these stations appearing in the Brass Pounders' League are noted for their consistent schedule-keeping and dependable message-handling work in amateur radio. Special credit should be given to the following stations (in the order listed) responsible for *over one hundred deliveries* in the message month: W6AMM, W3BBW, W8CHC, W9COS, W1MK, W2AVP, and W9AIN Deliveries count! A total of 200 or more bona fide messages handled and counted in accordance with A.R.R.L. practice, or just 50 or more *deliveries* will put you in line for a place in the B.P.L. Why not make more schedules with the reliable stations you hear and take steps to handle the traffic that will qualify *you* for B.P.L. membership also!

OFFICIAL BROADCASTING STATIONS

Changes and Additions
(Local Standard Time)

W6DHM, Mon. Wed. Thurs. 7:15 pm. and Sunday, 2:30 am.; W8HD, 7135 kc., 7:30 pm. Mon. and Fri.; W9DBJ 7000 kc. Mon. Thurs. 6:30 pm, Sun. 2:00 pm and Sat. 6:00 pm., W8DME, 3965 kc. Mon. and Fri. 7:00 pm; W9CPO, 7000 kc. 12:30 pm Tues., 3500 kc. 12:30 pm Friday.; W8DED, 3795 kc. Tues. and Thurs. 6:30 pm and Sun. 3.00 pm; W4CU, Sun., 7000, 10 am, 3 pm; W1AQL, 3500 kc. (80 m.) Mon., Wed., Fri., 7 am.

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Don't forget the Governors-to-President Relay—March 3 and 4. See details elsewhere in this issue. Plan to take part and get ready now.

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ELECTION NOTICES

To all A.R.R.L. Members residing in the Sections listed below:

(The list gives the Sections, closing date for receipt of nominating petitions for Section Manager, the name of the present incumbent and the date of expiration of his term of office.) This notice supersedes previous notices.

In cases where no valid nominating petitions have been received from A.R.R.L. members residing in the different Sections in response to our previous notices, the closing dates for receipt of nominating petitions are set ahead to the dates given herewith. In the absence of nominating petitions from Members of a Section, the present incumbent continues to

hold his official position and carry on the work of the Section subject, of course, to the filing of proper nominating petitions and the holding of an election by ballot or as may be necessary.

Section	Closing date for petitions specified of present year on or before noon 1929	Present SCM	Present term of office ends 1928
Western N. Y.	Feb. 20	C. S. Taylor	July 1
Nevada	Feb. 20	C. B. Newcomb	Sept. 15
Philippines	Feb. 20	J. E. Jiminez act'g	Dec. 2
Virginia	Feb. 20	J. F. Wohlford	Dec. 2 1929
Arizona	Feb. 20	D. B. Lamb	Jan. 3 1928
Ga-S.C.-Cuba-P.R.-Isle of Pines	Feb. 20	H. L. Reid	Aug. 2
Florida	Feb. 20	C. E. Ffoulkes	(resigned) 1929
Sacramento Valley	Apr. 8	C. F. Mason	May 6
San Diego	Feb. 20	G. A. Sears	Feb. 2
Los Angeles	Apr. 8	D. C. Wallace	Apr. 27
Oregon	Apr. 8	R. H. Wright	June 2

Due to the resignation of Mr. C. E. Ffoulkes, W4LK, in the Florida Section of the Southeastern Division, effective at once, nominating petitions are hereby solicited for the office of Section Communication Manager, and the closing date for receipt of nominations at A.R.R.L. Headquarters in Hartford is herewith specified as noon, February 20, 1929.

Canada

Nominating petitions for Section Managers in Canada should be addressed to Canadian General Manager, A. H. K. Russell, VE9AL, 5 Mail Building, Toronto, Ont., Canada. To be valid, petitions must be filed with him on or before the closing dates named.

			1928
British Columbia	Feb. 20 '29	E. S. Brooks	Dec. 2 '28
Saskatchewan	Feb. 20 '29	W. J. Pickering	Dec. 2 '28

To all A.R.R.L. Members Residing in the Sections listed:

1. You are hereby notified that an election for an A.R.R.L. Section Communications Manager, for the next two year term of office is about to be held in each of these Sections in accordance with the provisions of By-laws 5, 6, 7 and 8.

2. The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The Ballots mailed from Headquarters will list the names of all eligible candidates nominated for the position by A.R.R.L. members residing in the Sections concerned.

3. Nominating petitions from the Sections named are hereby solicited. Five or more A.R.R.L. members residing in any Section have the privilege of nominating any member of the League in their Section as candidate for Section Manager. The following form for nomination is suggested

(Place and date)

Communications Manager, A.R.R.L.
1711 Park St., Hartford, Conn.

We, the undersigned members of the A.R.R.L. residing in the ..... Section of the ..... Division hereby nominate ..... as candidate for Section Communications Manager for this Section for the next two-year term of office.

(Five or more signatures of A.R.R.L. members are required.)

The candidate and five or more signers *must* be League members in good standing or the petition will be thrown out as invalid. The complete name, address, and station call of the candidate should be included. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the closing date given for receipt of nominating petitions. There is no limit on the number of petitions that may be filed, but no member shall sign more than one such petition.

4. Members are urged to take initiative immediately, filing petitions for the officials of each Section listed above. This is your opportunity to put the man of your choice in office to carry on the work of the organization in your Section.

—F. E. Handy, Communications Manager.

ELECTION RESULTS

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections on or before the closing dates that had been announced for receipt of such petitions. As provided by our Constitution and By-Laws, when but one candidate is named in one or more valid nominating petitions, this candidate shall be declared elected. Accordingly election certificates have been mailed to the following officials: (These officials will welcome your monthly activity reports.)

Section	Address	Two-year term begins 1928
Louisiana	M. M. Hill, W5EB, Oakdale	Dec. 20
San Francisco	C. F. Bane, W6WB, 262 Castro St., San Francisco	Dec. 20
West Virginia	F. D. Reynolds, W8VZ, 1680 3rd Ave., Huntington,	Dec. 20
Alabama	S. J. Bayne, W4AAQ, 9 Park Ave., Montgomery	Dec. 20
Nova Scotia	A. M. Crowell VE7DQ, 69 Dublin St., Halifax	Dec. 20

In the Southern Minnesota Section of the Dakota Division, Mr. Joseph C. Pehoushek, W9EFK, 130 Warwick St., S. E., Minneapolis, Minn. and Mr. Carl Frank, W9COS, Rochester, Minn. were nominated. Election results: Mr. Pehoushek, 32; Mr. Frank, 16. Mr. Pehoushek therefore has been declared elected, his term of office beginning January 9, 1929.

DIVISIONAL REPORTS

ATLANTIC DIVISION

WESTERN PENNSYLVANIA—SCM, A. W. McAuly, W8CEO—In spite of a spell of sickness, W8CHC leads the gang again with a total that makes the rest of us look as though we were standing still, schedules, speed and soliciting account for the traffic. W8XE reported by telegraph. Most of the staff was away for the holidays the latter part of the month. W8CFR had a visit from sb-IAW for a few days. How they must have chewed the old sock after that Dyott traffic work. W8BGW has a new Zepp antenna but nothing but punk tubes. W8AW was QSO U. of Mich. Greenland Expedition and took 11 messages. W8CEO finally closed his marathon schedule with W4JR. It ran five years without a QSK. W8GI has been busy with BCL radio sets for holiday use. W8CNZ has a new MO-PA set going. He has been QSO Wilkins Expedition. W8DKS says things are a little slow there. W8CMP is back from the west coast where he spent some time in a hospital. We hope that he keeps well from now on. W8DNO was home from school for a few days. He says there is plenty of traffic. W8AYH has a new 3500 kc. transmitter. He was QSO the SCM. W8AGO keeps up the good DX traffic work. W8AJE has his transmitter working well with a 201-A. ExW6CKX has moved to Erie and is assembling a transmitter. W8VF is after some skeds. C. R. Perry, a new Erie ham, will soon have his license. W8BVG says his note has degenerated from xtal to RAC. The Erie Club elects new officers the first of the year. We hope that the club remains as active as ever. Two very promising hams from Altoona reported with good traffic totals this month. They are W8CQN and W8DJS. A couple more reports like that and the SCM will be sending them some nice new wall paper. Thank you, fellows. Altoona lost a good ham when W8CES moved to Pittsburgh. W8BNR has been having some hard luck. He has been sick most of the past two months. W8AMU is troubled by an ungrateful BCL who wants to close him down. Altoona has a good radio club. W8CQN is secretary. The A.T.A. of Western Pa. has organized Sunday afternoon QSO parties on 3500 kc. It is like the old local rag chewing parties we used to have in the spark days. The SCM has been QSO several members. Some more good stations are needed for ARRL broadcast work. The requisites are a good steady frequency, a decent fist, and regular operating times so that reliable schedules may be kept. Are there any takers?

Traffic: W8CHC 1876, W8XE 168, W8BGW 40, W8ABW 28, W8CEO 23, W8GI 19, W8CNZ 14, W8DKS 7, W8CQN 322, W8DJS 225, W8AGQ 23, W8DNO 15, W8AYH 3, W8CFR 104.

MARYLAND - DELAWARE - DISTRICT OF COLUMBIA—SCM, H. H. Layton, W3AIS—Maryland: W3BBW, our RM, made the BPL this month with a large total of traffic. W3TR is back from

his 15 days leave ready to start the New Year right with a good size traffic list. W3CGC says he will have to cancel all skeds as he is QRW college. Delaware: W3ALQ is working on a 28 mc. receiver. W3AJH has a 50 perking on 7140 kc. Reports traffic hard to get now days. W3WJ is now on 3660 kc. with CC. W3AIS will generally be found every night at 11:30 on 3710 kc. Those of the section are requested to listen for him. Dist. of Columbia: W3GT had the misfortune of blowing his transmitter up. However, after repairs were made, Wilson turned in a good traffic total. W3NR is back with us and is on the air with a new outfit. FB. W3ASO works 7317 kc. in day time and 3797 kc. at night.

Traffic: Md. W3BBW 335, W3TR 28, Del. W3ALQ 3, W3AJH 5, W3WJ 31, W3AIS 23, W3GT 76, W3NR 52, W3ASO 35.

SOUTHERN NEW JERSEY—SCM, M. J. Lotysh, W3CFG—Your SCM is very much pleased with the manner in which you fellows have responded this month and hopes it is the beginning of a new era for us. W3CFG again leads and manages to make the BPL. W3ARC turns in a fine total in spite of business. Good work, Hob. W3ATJ has a fine total as the result of 3500 kc. operation. W3AOC with 250 volts on a 50 watter works west coast easily and has good total. W3ARN threatens to increase power. He and W3ARR turned in fine totals and are fine ORS prospects. W3BO turns in his first report in several years. Glad to have you back, OM. W3BWJ increased his totals with a good sked. W3KJ surprises us with a total. W3ATP and W8ABF handled a few in spite of trouble with sets. W3BEI's latest complaint is BCL antennas. Let's have some action, OM. W3SJ got his commercial ticket. W3AIO will be back again soon. We are sorry indeed to have W3ZI request cancellation of his ORS due to business pressure. Hope to have you back again soon, Ed. W3BSD also had his ORS cancelled for non-reporting and general indifference. There are now OBS, OO and RM vacancies to be filled. Any volunteers. Don't forget the minimum total of 5 messages! Best of luck for 1929.

Traffic: W3CFG 204, W3ARC 63, W3ATJ 53, W3AOC 48, W3ARN 33, W3ARR 25, W3BO 25, W3BWJ 20, W3KJ 6, W3ATP 3, W3ABF 2.

WESTERN NEW YORK—SCM, C. S. Taylor, W8PJ—Some of the fellows who have taken good care to see that their stations comply with the new laws are ready and operating this month, while others are still reported under reconstruction. W8ADE has been rebuilding for two whole months, both receiver and transmitter. W8ALY of Rochester and W8AHK have been working locally on 28 mc. W8ALY says it's just as easy to work 28 mc. as it is 3500 kc. He has several pet schemes employed in his circuit. W8BSF hopes to be back with us again with 500 cycle push pull transmitter of huge size. W8AHC has been doing a lot of brass pounding by the looks of his report. W8AKZ has also added a few messages to his report. W8AVS has been doing good traffic work, too. W8BBP is now a regular traffic pounder. W8BEN has a bunch of schedules and traffic. W8BCM was not a bit slow this month, either. W8BJO has handled quite a bit of traffic with stations in Panama Canal Zone. W8BJM has a good traffic report. W8CPC is now working up to the 50 message mark. W8CVJ reports slight traffic and has a couple of schedules. W8DII is improving day by day and sent in a good one, and has schedules, too. W8DQP reports no tarffic due to transmitter being out of commission. W8DSP has a raft of traffic and schedules. Handling most all of his traffic early mornings. W8OA wants schedules with several stations, Buffalo included. Traffic from this station is on the increase. W8PJ has been operating again with traffic. W8TH has been ill with the flu, so report is very slight. Those who have made the BPL this month are W8AHC and W8DSP. A couple of others came close. There are about 80 or 85 ORS in Western N. Y. and of this large number, there are only 20% reporting regularly. If you should be cancelled for failure to report regularly, don't blame the SCM. A very careful check will be taken of stations reporting from month to month in the future and then something is going to happen. Reports shall be at the SCM's office not later than the 26th of each month.

Traffic: W8AHC 168, W8AKZ 79, W8AVS 40, W8BBP 81, W8BEN 24, W8BCM 90, W8BJC 56, W8BMJ 48, W8CPC 50, W8DME 5, W8DII 66, W8DSP 130, W8OA 41, W8PJ 19, W8TH 4, W8ARX 46.

EASTERN PENNSYLVANIA—SCM, J. B. Morgan, II, W3QP—W3ZF as usual leads the whole section with a scad of messages. He has changed his frequency from 3755 (79.9) to 3572 (83.9). W3AKB operates on 3500 and made the BPL with a few to spare. W8AVK on 3714 kc. made the BPL on his deliveries. W8WJ says that XMAS slowed things up a bit and that he thinks his crystal has the "flu." W8BQ now has a new xmitter ready to perk but waits for the meters. W8CWO handled over 100 in the 3500 kc. band. He has a new UX852. W8DHT hits the ball. W8AWO works at a radio store and also keeps the xmitter at home on 3615 kc. W3ADE is learning Morse code and has to lay off the air a bit to keep from mixing the two codes up. W3ANS worked the coast a couple of times. He is on 3500 and 14 meg. W3CDS is taking an interest in traffic. W3QP is still quite busy. W3AHZ is installing some 381's in place of his chemical rectifier.

We welcome three new-comers to the ranks of ORS: W8AWO, W8CWO, and W8DHT, all of Scranton, Pa. FB, OM's, and keep up the good work. Will some one volunteer the loan of an adding machine to help W3ZF add up his totals? Gud stuff, Don and Pat! In spite of the Xmas rush our totals for the whole section remain sound.

Traffic: W3ZF 862, W3AKB 239, W8AKV 176, W8WJ 163, W8CWO 116, W8DHT 77, W8AWO 74, W3ADE 74, W3ANS 54, W3CDS 35, W3QP 16, W3AHZ 6.

CENTRAL DIVISION

ILLINOIS—SCM, F. J. Hinds, W9APY—W9AGG passed his exam for first. Most of W9FI's traffic was foreign. W9IZ rid himself of key clicks with a key filter. FB, OM. W9AD is bursting out with a xtal 75 watter. W9ACU is now rebuilt with a new Zepp, 210 and a 350 volt Esco M.G. W9CNY also has a new Zepp. W9AFX has a 250. W9NV is televisioning a bit. W9BWL is building a shield-grid. W9CUO is now an "8" in Jackson, Mich. W9FT has come back to us with a bang. W9EYA has a new MOPA. W9FMR has BCL troubles (welcome to the ranks, OM). Hi. W9CNP and W9FWX made a visit to Chicago. W9CZL has some 281 tube rectifiers. W9AQA is an op at KNX, Hollywood, Calif. W9FWX has a 250 ala 1929. W9BZO is worried over his new screen-grid set. W9GV had his number 100 QSO with oa-5HG. FB, OM. Keep it up. Ex-W9UX is now W6ERM at Los Angeles, Calif. (Keep an ear open for him, gang). W9ERU has schedules in every direction. FB. He wants to see more Chicago stations on 3500 kc. How about it, gang? Be careful, fellows, and stay within our bands. Off wave operation is inexcusable from now on. Happy New Year to you all.

Traffic: W9DXZ 257, W9ERU 157, W9EJO 99, W9ASE 61, W9FT 61, W9AHK 44, W9AFX 39, W9ACU 35, W9FDQ 35, W9BZO 34, W9FCW 29, W9CNP 28, W9DOX 28, W9CZL 26, W9APY 25, W9FWX 25, W9AFB 21, W9CUH 20, W9FI 19, W9AD 16, W9ECR 13, W9IZ 12, W9AGG 11, W9ALJ 11, W9AWX 10, W9CZT 10, W9NV 10, W9AXZ 8, W9KB 8, W9AEG 6, W9ALK 6, W9DJ 6, W9CNY 4, W9EYA 3, W9FMR 3, W9BVP 1.

KENTUCKY—SCM, J. B. Wathen, III, W9BAZ—Many new calls are to be seen here this month. Keep coming, fellows, room for more. W9CMK moved his outfit from the garage to the house for the Jr. op. W9FKM is trying to make a MOPA perk. W9FQN is waiting for his power trans. to come back from the factory. W9AZY is ditto. W9CEE swears off the YLs for the New Year. W9ARU took a trip to Hartford. Says "sleep there is next to impossible." 'Sall right, you can sleep at home. W9BEH is waiting on 2-281's. W9BWJ got home for the holidays. W9BGA worked his first FO. W9AGP is waiting on hotel remodeling so he can get on the air again. This waiting business is as bad as the flu. Me, too, OM. W9MN is "fixing up the junk for winter work" and operating at WLW. Wow. W9DNA joined the W9JL crowd. Bowling Green has come to life with W9FZL, W9FZV, W9GAL, W9GBF. Western Teachers College will soon have a set going with Prof. Page at the key. FB. W9AZY, W9CEE and W9JL are now ORS. W9ATV let his slip. Prenez-gard! Two USNR units are now in charge of M. Utterback, according to W9AUH.

Traffic: W9FZW 14, W9ARU 5 W9CEE 3, W9BGA 3, W9DDH 1, W9JL 15, W9MN 8, W9ENR 2, W9OX 9, W9BAZ 3.

OHIO—SCM, H. C. Storck, W8BYN—The SCM is sure that a lot of you are, or were, buffaloed about 1929, and hopes you have gotten over that now. DX will probably be minus quantity on the other bands and communication conditions will be bad, we know, but traffic can and will still be merrily on in the 3500 kc. band so jump in and get your share of it if you still retain your enthusiasm for the good old game. Four made the BPL this month, just ended, and over 75% reporting had over 10 messages per. W8JA, ex-W8DBM, as usual leads the gang with 301, handling 63 the last day and getting half his total in the last six days. Certainly FB, OM. W8CMB, his rival for honors, comes second with 244, tho he wrecked his mercury arc or he would have had more. W8CFL worked hard, and just made the grade. He deplores the lack of active stations in Toledo for which city he had a lot of traffic. W8RN is with us again and makes the BPL with deliveries. He is working at WTK since KFNN layed up for the winter and won't have much time to work but see what he does with the time he has. W8APB has been doing good work with low power. W8DDK is still experimenting but handling traffic, too. W8CNO has been rebuilding and wasn't on the air. W8DIH says and rightly, that hundreds of messages delivered by mail go astray and into the dead letter office and that every delivery so made should have return address on envelope so check can be made. A good thought, OM. Let's keep that in mind. W8CWC says traffic is now on the "up and up". W8BAC says the same, also that the expected 204A didn't show up for Xmas. Hi. W8BFA was laid up with the flu and has been pretty QRW but turned in a nice total just the same. W8CXW is still using 201-As but is doing good work. W8BSR got all of his in the 7000 kc. band. W8CNU wishes that Xmas rush traffic was the rule the year around. Hi. W8BBR says the trolley cars in Cincy must be tuned to 80 meters so he has dropped to 40. Hi. W8GZ is doing some good work on 28 mc. but busted another 8000 kc. crystal to make up for it. W8AQ is just getting started in the traffic game and is looking for schedules. W8AYO does his work on the 7000 kc. band and says low total is due to rotten conditions there. He does good DX traffic work. W8OQ reports he is still trying to get the 1929 transmitter going. W8BOR has been rebuilding and will be going good when this appears. W8CFT has been QRW school but hopes to be on more now. W8DDQ is a high school station and would like to have schedules with other stations of same kind. W8ADS has also been busy at school as it is his last year. W8DDF reports that he has had 3 different receivers, 4 transmitters and 4 antennas on 20 this last month. That's a record, Hi. School is taking up entirely too much "ham" time. W8AMI reports he is busy that way, too. W8ALW is still with us but not heard much. And here comes W8DSY witth the school excuse. 'S OK tho, OM. W8DPF is catching up on his sleep since he has been off the air but will be back on again soon. W8DHS now has his new transmitter going and will have the rest rebuilt soon. W8DJV says higher calculus has his attention now. Some more school work. W8CLR is trying to get a station rigged up at O.W.U. in Delaware. W8CXD has not moved his transmitter to Akron, yet. EXTRA! W8BKM is rebuilt and on the air again. The SCM, W8BYM, has been too busy with his BCL service work to be on much and his station is not yet rebuilt. The old heap was built ALMOST 1929 anyway and will have to serve until some spare time comes along. I want to thank yon now for all your Holiday greetings and wishes. Same to you all and many of them. A few last words. The "dead" stations are weeding themselves out very nicely, thank you, and as they do, the totals and percentage for Ohio SHALL rise. Now, let's get after this traffic, gang, and the best of luck to you all in this new year.

Traffic: W8JA 301, W8CMB 244, W8CFL 200, W8RN 154, W8APB 60, W8DDK 59, W8DIH 59, W8CWC 51, W8BAC 48, W8BFA 38, W8BSR 31, W8CXW 31, W8CNU 27, W8BBR 21, W8BYN 19, W8GZ 19, W8AQ 19, W8AYO 15, W8OQ 13, W8BOR 12, W8CFT 12, W8DDQ 10, W8ADS 9, W8DDF 7, W8AMI 6, W8ALW 5, W8DSY 5.

WISCONSIN—SCM, C. N. Crapo, W9VD—The boys turned in their best reports this month and there sure were a lot of greetings in the air—a regular Scotch Christmas—send your Xmas greetings Free by Amateur Radio! W9DLD worked the Byrd Expedition and was reported as one of the loudest American stations heard. W9DEK says he is going to do his share to keep Wisconsin on top. W9BPW worked hard this month and is rewarded by getting in the BPL column at last. W9EBO has ten schedules in ten different states and still is yelling for more traffic. W9EWY says things were moving fast that month. W9BJY handled a lot of traffic to and from the Byrd expedition. W9EYH has a new Zepp for both 7000 and 3500 and is getting out fine on 2-201A tubes. W9FHU has schedules with W9ERU, W9DLD and W9EBO and going good. W9EYU says he doesn't like to handle so many rubber stamp messages. W9LV is keeping one schedule with W9DWN. W9SO has a schedule with W8DED. W9ARE working 14,000-7000-3500 and 1750 fone. and is putting in a 204A. W9DTK has resumed his schedule with W9EK on Wed. and Fri. nights. W9CVI is having more trouble with BCLs which keeps him busy building wavetraps. W9DND has a schedule with W9EYH. Says he is changing to 3500. W9BIB cracked his 3565 kc. crystal but will have another one ground before long. W9DTN is handling more traffic—trying for an ORS. W9ESM has an 852 and Rectobulbs on 7000 and will have fone on 3500 soon. W9OT can't understand why he gets better reports from self-excited set than he does from MOPA outfit. W9EMD didn't have much time during the holidays. W9DJK is too busy at the shop to get on the air. W9XH-EK crystals have been interchanged to put each transmitter in the new frequency bands. W9EQL visited W9VD during the holidays. W9FAW is getting good DX with a 210 on 3500. W9EZT has been out after DX this month.

Traffic: W9ELD 522, W9DEK 254, W9BPW 243, W9EBO 204, W9EWY 109, W9BJY 102, W9EYH 67, W9FHU 64, W9EYU 51, W9EV 45, W9SO 40, W9ARE 35, W9DTK 34, W9CVI 24, W9DND 19, W9BIB 15, W9DTN 15, W9ESM 10, W9OT 9, W9EMD 8, W9DJK 6, W9XH-EK 5, W9EQL 5, W9FAW 4, W9EZT 4.

MICHIGAN—SCM Dallas Wise, W8CEP—W8DSF is now an ORS and is working a couple of schedules. W8CKZ has been QRW work but now has a remote control set in operation. W8AUB has been experimenting with 3500 kc. fone. W9CE reports but has no news. W8ASO is still looking for recruits for the Naval Reserve. W8ACB blew his 210 and 281's and had to wait until Xmas for new ones. W8DCW worked W7AAE with 14 watts input. W8AHM reports he works 1500 miles on one-half watt input. He must have been at the G.R. Hamfest. W8BGY has to QRT for the BCLs now and in spite of that leads the Michigan traffic list. W8BRS has been overhauling the outfit for the new year. W8CAT has been using fone on 3500 kc. and worked W9BWI with it. W8BCI has been out on a business trip so has been silent most of the time. W8BAX was so QRW with P.O. work during the holidays that he didn't get much time to operate. W8CED has been working a schedule with AP1, a ship on its way to San Francisco via the Panama Canal. W9BTQ is now using the push pull transmitter as shown in December *QST* and reports it as being FB very. W8ARR is now working the 3500 kc. band. W8CU says the new Zepp is FB and that he will have a push pull xtal control outfit ready soon. W8DVF is using both 3500 and 1750 kc. fone. W8DYH sure knows where to get the traffic. He now has an outdoor antenna and works the 3500 band as well as the 7000 kc. W8RD has a nice fone going on 3500 kc. and also manages to handle a few messages. A Wieienga of W8CHT now has a station at home under the call W8AZW. W8DED now comes forward with the dope that too much traffic gets on a fellow's nerve but it doesn't seem to bother his any. W8BV has been doing great DX with a 210 and tube rectifiers. W8CWM has been attending MSC but was on the air during the holiday vacation. W8DAQ becomes more active. Do not forget the date of the February Michigan QSO party. Friday evening at 7 pm EST.. February 22, might call it Washington's Birthday QSO party. Here's hoping for a good night.

Traffic: W8DVZ 2, W8ACB 3, W8AHM 7, W8GBY 311, W8BRS 23, W8CAT 23, W8BCI 71, W8BAX 2, W8CED 11, W9TQ 46, W8ARR 12, W8CU 8, W8DVF 2, W8DUH 290, W8RD 35, W8ASO 11, W9CE 14, W8AUB 23, W8CKZ 8, W8DSF 23, W8DED 304, W8CWM 10, W8AZW 11, W8CEP 18, W8DJR 6, W8BV 2, W8DAQ 130.

INDIANA—SCM, D. J. Angus, W9CYQ—W9ARR traded his radio for a wife. W9CTU moved to Evansville. W9FCE is back at Dodge's absorbing more radio. W9EXW is going big on all bands at Whiting, Ind. W9CMV is on regularly but reports foreign signals weak. Will soon be on crystal control. W9AIN again leads the state. Is now rebuilding putting in crystal control. W9ELX is second high. Work regularly on 3500 kc. band. W9EKW reports that the Richmond Radio Club has reorganized and has a new

set of officers and a lot of pep. W9EKW is third for traffic in the state on crystal control 3500 kc. band and on every evening. W9BZZ is building a new transmitter. The Richmond Radio Club members use little fones for talk around town. W9EVA is going to Dodge's Telegraph Institute. W9DPV worked RADI in a South American port. W9FQ has 4 daily skeds going. W9ASX is making all skeds on 3500 kc. now due to bad traffic conditions on 7000 kc. W9GGJ is a new ham at South Bend. W9BZZ is Secretary of the Richmond Radio Club. W9DBJ is on again on 7000 kc. W9PF is going on his farm near Angola. W9EVB is using 145 volts on 3500 kc. and gets out OK. W9HGE got in a few days operating during the Christmas vacation. The Indianapolis Radio Club elected new officers as follows: Pres: Robt. B. Annis, W9CUD; V. P. Fred Finehout, W9CLO; Secy-Treas, G. K. Johnson. The annual code school is going full blast with about 20 members.

Traffic: W9AIN 497, W9ELX 292, W9EKW 217, W9CMV 92, W9EVA 76, W9FQ 73, W9ASX 37, W9EPH 26, W9DPV 26, W9BZZ 20, W9DBJ 16, W9EVB 10, W9EGB 10, W9FKE 10, W9CNC 6, W9GCO 4, W9FXO 1, W9FZQ 1.

DAKOTA DIVISION

NORTH DAKOTA—SCM, B. S. Warner, W9DYV-W9BVF leads the whole section with a respectable total. He keeps several schedules with traffic moving in good shape. FB, OM! W9IK still uses fone on the 1720 kc. band and gets good reports from Okla., Ill., and Georgia ranging from R6 to R9 using one UX210 tube. W9FCA has worn out one set of B batteries and has replaced them with storage B batteries. He has been working in the 3500 kc. band recently. W9DM is on his school vacation and has been assisting W9BVF in erecting a new Zepp aerial. W9BVF is on the sick list this month. W9DYV has been off on account of sickness and unable to do very much relay work.

Traffic: W9BVF 77, W9IK 4, W9FCA 3, W9DYV 3.

SOUTH DAKOTA—SCM, D. M. Pasek, W9DGR—W9DB is down on 28 mc. now using a 210 and Colpitts and has heard all districts. He has a new 1929 receiver and is working all bands. W9DGR is building a new plug-in condenser receiver but doesn't have much time to operate. Thanks to W9DNS, we have a good report on Sioux Falls this month. W9DRB is active on 7000 kc. and 14 mc.; W9DNS on 3500 now and installing a Hg arc; W9ID also on 3500 and W9DIY is monkeying with xtals. W9DWN is keeping his skeds on 7000 and is going to play a sax as a sideline. W9EUJ had tough luck when his antenna and batteries went down at the same time. W9EUH rebuilt his xmitter using 281's and improved his sigs considerably.

Traffic: W9DWN 213, W9DB 30, W9EUH 21, W9DGR 20, W9DNS 9, W9EUJ 2.

NORTHERN MINESOTA—SCM, C. L. Jabs, W9BVH—The honors again go to ex-SCM W9EGU who is well in front of traffic. He keeps six skeds and reports the sked with WFBT still going strong. He also reports ZL stations are coming in well in the new band and plans on getting another crystal and a new rectifier. W9EGN sends in a fine report and says he is now Asst. Mgr. in auto sales. W9CTW will be on xtal controlled very soon. W9EGF has a new Zepp antenna and has one sked. W9CKI reports that the Duluth gang is getting going again and looks for more activity. He and the SCM had a very fine chat recently. W9EHO is heard on regularly with a fine note and strong signal. W9ERB has not been on much and reports the air is dead. W9EHI is unable to keep skeds due to poor conditions. W9CF is getting 281's and hopes to work out better. W9DPB is all set for 1929 but has QRM from some of the ORS of this section and is looking forward to many more of them. At present he is grinding a new quartz plate for the new band. W9CIY keeps three skeds and reports W9CWA has quit the ham game and gone to the city to make his fortune. The SCM did this twelve years ago and is still looking for the end of the rainbow. Hi. The hams from the Iron Range called on the Duluth gang and all called on W9DOQ to make him happy. The SCM might add here that he raised W9DOQ on a directional CQ recently and after traffic was cleared, I found to my surprise that he has spent over nine years in bed, having only the use of one hand. His transmitter was built by Duluth hams and from what I have since learned, he operates his receiver with a stick attached to the dial. He operates on about 7150 kc. with a pure DC note. Give him a buzz, fellows, as he greatly appreciates your QSO's. The SCM joins the gang in wishing him a Very Happy New Year. W9AKM has changed to 3500 kc. to look for traffic. He also installed a new key thump filter to pacify the BCLs. W9DUV is too busy with his electrical work to be on the air much. W9FVU has trouble with his antenna but keeps lively correspondence with hams. The report this month shows a very marked increase over last month. I believe almost every active station reported and here is a warning—All stations who do not report for three consecutive months will have their ORS cancelled!!!! So if you are inactive, drop the SCM a line so he can put you on the inactive list until such time when you become active again.

Traffic: W9EGU 201, W9EGN 149, W9CTW 125, W9EGF 60, W9CKI 29, W9EHO 23, W9ERB 21, W9EHI 17, W9CF 15, W9DPB 12, W9BVH 11, W9CIY 7, W9AKM 6, W9BBT 2.

SOUTHERN MINNESOTA—SCM, D. F. Cottam, W9BYA—Well, gang, I am still on the job and no doubt the next report will come from the new SCM. There were two nominations, W9COS and W9EFK. The result will no doubt be known by the time this is published. Whoever is elected deserves all of the support possible and all messages handled should be reported to him so it will be included in the regular monthly report. There are large numbers of messages handled in this section every month that are not recorded or reported. This should not be and I hope a New Year's resolution will be made covering this. W9COS with skeds all over the U. S. is highest station this month. He says he has never seen so much Christmas sentiment in a solution of ether. W9AIR has a nice bunch of skeds and a new Ford. W9EFK keeps a couple of skeds and had some hard luck by blowing his 222 tube. W9CKU visited W9EFK and W9BYA. W9EOH was QSO nn-1NIC this month. W9BHZ keeps one sked. W9DOP is rebuilding. W9ERT is on 14 mc, and 7000 kc. W9DHP keeps one sked and will rebuild soon. W9DBC is very QRW and wishes everyone a Happy New Year. W9DMA says radio is bad for him. Can't hear anyone after 8 pm. W9DEQ is so busy he may have to discontinue his ham work. This is the beginning of a New Year and all good wishes go to you and I hope you will all enjoy our amateur privileges.

Traffic: W9COS 282, W9AIR57, W9EFK 33, W9EOH 17, W9BHZ 16, W9DOP 14, W9ERT 5, W9DHP 4, W9DBC 3, W9DMA 2.

DELTA DIVISION

MISSISSIPPI—SCM, J. W. Gullett, W5AKP—Two of the Meridian gang that have been off the air for about two years are now coming back. Eugene Boyer of Iadianola, Miss., who is an ex-Navy wireless operator, will be on the air with a UX852 and a motor-generator using TPTG circuit within the next two or three weeks. Welcome to our midst, OM. The new regulations seem to pep up the Mississippi gang considerably. W5AED is now installing a crystal control transmitter using 1750 kc. for fone and 3500 kc. for straight CW. FB, OM. W5FQ has a schedule with W4KY every Sunday morning at 8:00 am CST. W5AJJ is using a new transmitter, the circuit being a TPTG affair and he has a schedule with Havana, Cuba. W5ANP and W5GG failed to report this month. Say, gang, how do you expect to retain your official Relay Certificates if you fail to report regularly every month. I hate to cancel your certificates but if you don't report, I will have to do so. W5AKP is on a trade for a new REL wavemeter and a S-M "Round the World Four" short wave receiver and it is hoped that he will close the deal. He is still on 14 mc. but it won't be long now until he tries 7000 kc. again. W6DUO ex-W5QZ is spending the holidays with his home folks in Meridan, Miss. W5AGV and W5AQU are at home spending the holidays and W5AGV is operating at W4KY during the school months.

Traffic: W5AKP 78, W5AJJ 59, W5FQ 40, W5AED 27.

ARKANSAS—SCM, H. E. Velte, W5ABI—It is hoped that all of you have by this time adjusted your apparatus to 1929 standards. W5EP at Springdale leads the gang in traffic handling. W5SS is still on fone and has a schedule with W9BET. W5AUU is working for the Bell Telephone Co. and has moved to Little Rock. W5AQX is busy installing broadcasting stations. W5IQ is all set for 1929. W4LU recently paid W5ABI a visit and worked him on sked when he got home. W5HN is getting out very nicely with his pair of 210's. W5BDD says that the 852 tube makes a nice rectifying tube. Hi.

Traffic: W5EP 25, W5ABI 16, W5SS 2.

TENNESSEE—SCM, Polk Purdue, W4FI—Only two reports were received, gang, so ORS cancellations are next in order. W4LX, W4TD, and W4KM had

better get their reports in next month. W4ACW has applied for an ORS. W4ABZ is our new Route Manager and is the only one handling traffic this month. W4HK has been appointed O.B.S. W4SP was sick with the flu but is back on the air again. The SCM would like to hear from every section of the state and remember, gang, we need more ORS. What has happened to the Memphis gang? Whether you are an ORS or not, let's hear from you next month, OMS.

Traffic: W4ABZ 12.

HUDSON DIVISION

EASTERN NEW YORK—SCM, F. M. Holbrook, W2CNS—W2AYK now on 3500 kc. for good because so FB for traffic. W2SJ did good work with three schedules but QRM from stations with buzzer modulation. W2AUQ says many thanks to Ross Hull for dope on special tube filter giving DC signals. W2CUF relayed 30 messages for Byrd expedition. W2AXX worked his first So. American station, a ship off Brazil using NK-1EE (if anyone knows who this is, please advise, W2AXX). W2AQL is installing crystal control. W2ANV kept five schedules on 3920 kc. W2ABY worked EG and ES on 14 mc. and EF on 7000 kc. W2BKN reports traffic low but DX good. EX-W2HB is back on the air as W2HF. W2ACY finds *QST's* four-tube set with screen grid OK and cuts out WGY with rejector trap; he was 22nd on Navy Day Honor Roll. W2AGR attended A.I.E.E. meetings.

Traffic: W2AYK 51, W2SJ 42, W2AUQ 39, W2CUF 38, W2AXX 36, W2AQL 27, W2ANV 18, W2ABY 15, W2ACY 9, W2ALI 5, W2BKN 5, W2CNS 3.

NEW YORK CITY AND LONG ISLAND—SCM, M. B. Kahn, W2KR-W2AAG—Manhattan: W2BGO, Manhattan's wide awake Route Mgr., through many early morning schedules, makes the BPL and leads this Section in traffic. W2SC lost his traffic total this month due to illness but expects to lead the BPL next month. W2KR is on 3500 kc. with a crystal controlled fone during the evenings. W2OV comes through with a nice traffic total. W2BCB is one of the many who report *QST's* 1929 shield grid receiver FB. W2CUQ promises a regular report in the future. W2BNL almost forgot his report. Bronx: W2APV due to vacation lost most of his traffic. W2CYX is going to Cuba again. W2BPQ is doing his usual fine work. W2BBX is going to tackle his transmitter for the sixth time. Hi. W2AET moved but still handled a few messages. Brooklyn: W2PF still quite active and reports many schedules. W2BO handled some important traffic. W2CRB reports DX pretty good in new bands in spite of QRM. W2BRB still sticks to 14,000 and 28,000 kc. W2AJL reports little activity. W2BFQ sent in his report just in time. Long Island: W2AVP leads L. I. as usual in traffic and reports good Xmas traffic. Xmas interrupted W2AIZ in his work. W2AEU-W2ASS due to school has been rather inactive but hopes to do better next month. W2AZU has been using fone on 3500 kc. W2BJK sent in a late report last month.

Traffic: Manhattan: W2BGO 391, W2SC 264, W2KR 110, W2OV 55, W2BCB 43, W2CUQ 18, W2BNL 6. Bronx: W2APV 80, W2CYX 72, W2BPQ 67, W2BBX 14, W2AET 7. Brooklyn: W2PF 41, W2BO 26, W2CRB 20, W2BRB 8, W2AJL 6, W2BFQ 132. Long Island: W2AVP 238, W2AIZ 37, W2AEU 24, W2AZU 13.

NORTHERN NEW JERSEY—SCM, A. G. Wester, W2WR—Traffic dropped off this month, also a good number of ORS have again failed to report so a few will be dropped from the list. Traffic handlers who have not done so please get in touch with the SCM so that a good traffic presentation can be had in ORS for our section. W2AT one of our best traffic ORS has resigned due to heavy business pressure. W2AOS has been appointed ORS. W2GW reports plenty of new stations in Caldwell and Verona. New fellows are W2BPG and W2JZ. W2AUU in Essex Fells got rid of his flea power and now uses a 210. W2DX is installing crystal control for 3610 and 7200 kc. W2JC manages to handle a fair amount of traffic. W2MD maintains two fine schedules with African stations. W2CJX lost his mast in a recent wind storm and has resorted to a neighbor's tree for the present. W2BY maintains three schedules on Saturday mornings with first district stations. W2BIR burned out his fifty so now uses a 210 which steps out just as good. W2IS leaves shortly for a vacation in Florida. We hope he takes a portable xmitter with him. W2BAL still finds it hard to get time for amateur radio. W2JX still is off due to entering the 5th stage of radio. W2AOP just missed out on the BPL due to storage battery going west. W2CP missed out on his report which would have jumped up our traffic figures.

Traffic: W2AOS 59, W2CW 9, W2DX 40, W2JC 14, W2MD 92, W2CJX 36, W2BY 13, W2BIR 16, W2IS 4, W2BAL 8, W2AOP 75.

MIDWEST DIVISION

IOWA—SCM, H. W. Kerr, W9DZ—The non-ORS still lead the Iowa ORS in number, reporting and taking the lead. Comparisons show decrease of five hundred messages over a year ago. What's wrong? Why not say "flu"?—it's true. W9DGW, W9EJQ and W9EDW handled more messages this year than any three stations of the corresponding month a year ago. FB, folks, and it's appreciated. W9DGW leads and W9EJQ in the same town follows closely, while W9EDW slackened his pace to meet the New Year's "right" with a 250 xtal control on 7255 kc. W9BCA makes BPL on deliveries and DX KVUA, Hank Ford's rubber plantation in Brazil. W9SZO still can't eliminate key-clix. W9DZL has a new operator, the Mrs., who has her own call W9GHJ. W9DEX schooling at Des Moines will have a new station and his mother will keep W9DEX on the air. The Mrs. at W9EIW sends in the report for the YL. Suffrage is on the increase in Iowa and the YL and OW's Aid Society will soon be a reality. W9BAT and W9EFS are going again. Our pill-maker at W9DPL raises his ante to 14. W9CZC wants a rear-left-dog for the gig on his xmitter to get going again. W9FFD is FB on the 7000-3500 kc. bands. W9EHR after a long silence is back with a 50 and installing mercury-arc, on 14 mc, 7000 kc. and 3500 kc. W9EFH reports some activity at Newton. W9DXP of pre-war 9KQ and 9OA is active at Des Moines and reports a revival in the capital city. KSCJ at Sioux City broadcasts code daily at 5:40, auspices of the Tri-State Amateur Club. W9EFH wants QSO television experimenters. W9EIT of pre-war 9GL and post-war 9UA has been revamped. Send your traffic reports the 26th to the SCM at Little Sioux, Iowa. New hams are numerous—we want to hear from them all.

Traffic: W9DGW 461, W9EJQ 436, W9EDW 396, W9BCA 189, W9DZW 78, W9FZO 57, W9EIW 44, W9EHN 44, W9FAI 43, W9DZL 29, W9BAT 28, 9FJA 27, W9FFD 20, W9ASM 14, W9DPL 14, W9CZC 11, W9EHR 8, W9CKQ 7.

KANSAS—SCM, J. H. Amis, W9CET—Traffic takes another jump. FB, fellows, keep the good work up. W9BPL has a MO-PA going and says its FB. W9ESL sends in his first report and wants some fone skeds on 1750 kc. W9FTY is putting in 281's and will soon junk the slop jars. W9HL fails to keep any skeds so his traffic suffers. W9FUG has ambitions to be an ORS. Time will tell, OB. W9FTY now has D.C., but says sickness in the family kept his total down. W9CKV also says sickness interferes with traffic but is working regularly on 3500 kc. W9CET has the xtal bug and is playing with a 210 rig between skeds. The two RMs W9CFN and W9FLG report big things in traffic for the coming year. W9CFN has a 1929 TP-TG rig on 3500 and 7000 kc. and is working 4 skeds a day. W9FLG is using a 1929 Ultra-audion on 3500, 7000, 14,000 and 28,000 kc. and has ten skeds. Give the RM's your support, fellows, and let's make 1929 the biggest year in the history of the section.

Traffic: W9BPL 12, W9FLG 190, W9ESL 34, W9CFN 212, W9FYP 84, W9HL 12, W9FUG 27, W9FTY 94, W9CKV 38, W9LN 89, W9BHR 37, W9CET 221.

NEBRASKA—SCM, C. B. Deihl, W9BYG—W9ANZ says he feels quite a bit better these days and hopes to be on more now. W9QY has more time for his radio now. He reports three new stations in Nebraska. W9EEW is very busy on his railroad and with his BCL work so isn't on much as he would like. W9DVR is completely rebuilding his transmitter for 1929 and expects to knock them all dead soon. W9BYG is still cussing his location and dead spots. W9FAM has entered into the transcontinental relay chain and is sure laying them low these days. W9DNC sure is stepping to it and handles plenty of traffic and all in the early morning hours, too. FB. W9DI wins the plum this time with a cool 150 also reports new station at Milford, Neb. W9BOQ is on 3500 kc. and is open for business. W9BLW overhauling the set for 1929, also for fast QSY. W9CHB is busy with school so isn't on very much, but says that he feels fine since he is a Junior I.R.E. now. Congrats, OB. W9CDB complains his new 1929 transmitter is so sharp that they have trouble finding him. W9BQR is just coming to after the Xmas rush. He says that he is promoted after the first of Jan. with a very agreeable increase to go with it. Congrats, Arthur, we are all glad for you. W9EUT hands in a very fine

report but we regret that he is leaving for a short time, and we hope for his speedy return but wish him success wherever he goes. We are very pleased to receive the first report from E. B. Harbert, Radio W9FUP, Benedict, Neb., and hope that these reports continue.

Traffic: W9ANZ 11, W9QY 20, W9DVR 8, W9FAM 148, W9DNC 78, W9DI 150, W9BOQ 6, W9BLW 6, W9CHB 3, W9EUT 83, W9FUP 2.

MISSOURI—SCM, L. B. Laizure, W9RR—Quite a number of the old stand-bys were the victims of illness of this month, cutting down on totals when an increase was expected. Several unaccountable failures to report also helped defeat plans for record smashing, probably due to holiday QRM. In St. Louis, W9BMU, W9BEQ, W9BEU W9BHI, W9DZN and W9DLB were the leading traffic stations, with less than thirty messages separating the last from the first stations. W9ZK, W9BHF and W9DUD are recovering from the effects of trying to tune in on Santa Claus, guesses the SCM. W9AYK went over the top again, apparently trying to double his last month's score and would have done so except for holiday QRM on job and inability of connections to keep skeds during holidays without breaks. He added a couple of skeds, also. W9DAE lost a week enjoying the flu which cost him 50 messages. W9BJA has been QRT the entire month with pneumonia. W9BQS has post-office job QRM. W9GCL comes in with a first report. W9ASV boosted his total over November. He says no rubber stamp messages get in his totals. W9CJB is on days during Jan. and nights during Feb., has put in UX250 but says not as good as 210. W9FAL is a new station in Festus and operates days. W9CDF is rebuilding. W9ECS says everything's FB and a visit to W9DUD was enjoyed. W9FBF kept the set working overtime with 2 ops when W9FSI came home for Xmas. Ham visits still in order in this section. W9DKG has a 212D on 7000 and a 210 on 14,000 kc. with another 212D as amplifier for the 210. WFAT copied regularly but no QSO yet. Ham club starting up at Mo. Univ. W9LI is QRT with school QRM and can't decide whether to say QRT or not. W9TNJ reported by radio, thanks to W9GAD, who sends in his first QSL to the SCM. W9EPX was QRT most all month and spent holidays with W9EPY in Chi. Another new ham is opening in Springfield. W9GBC has closed up. W9GBT is going in Centerview and wants to handle traffic. W9TJ is back in Kansas City after a two years' absence. W9GAD is a new station in K.C. Traffic in K.C. was not so great this month due to a number of fellows being shut down for rebuilding and some cases of flu. W9RR kept up vigorous brass pounding when possible but was off about one week due to holidays. Missouri still holds three places in the BPL as last month in spite of the handicaps mentioned. We propose to pound brass as regularly as possible in 1929, and if there is any time left over, let's use it in trimming up transmitters and receivers and last, but not least, in swatting BC station harmonics.

Traffic: W9BMU 45, W9BEU 37, W9BEQ 30, W9BHI 25, W9DZN 21, W9DLB 20, W9DSU 6, W9BOS 3, W9GCL 2, W9DAE 266, W9ASV 106, W9CJB 8, W9CDF 16, W9ECS 42, W9FBF 10, W9DKG 96, W9FNJ 23, W9AYK 602, W9DQN 18, W9FIO 9, W9FTE 14, W9AHZ 12, W9FHV 2, W9EQC 82, W9ZD 2, W9EMH 4, W9DOJ 4, W9TJ 20, W9CAD 2, W9RR 327, W9DHN 21.

NEW ENGLAND DIVISION

CONNECTICUT—SCM, C. A. Weidenhammer, W1ZL—It seems rather shabby to start the New Year with a threat, but it must be done. The fitful reporting and continued silence of some of the gang have made some sort of discipline imperative. The ultimatum the SCM is about to issue was heard in ancient days by the earliest members of the ORS group. It is simply that those stations which do not report two months in succession, will be dropped. After all, that is only a restatement of the rules of the Communications Department. If a station operator feels that his set will be inoperative for a period of several months, his safest procedure will be to ask for a temporary cancellation of his ORS certificate. In that way he will be eliminating himself as "deadwood" which otherwise might detract from the general efficiency average of the Section's ORS contingent. A new ORS file is being made up. Snap out of it, gang! Connecticut's prospects were never brighter. The splendid Route Manager work of W1CTI, W1BHM and W1AOI should spur us on. Why not make 1929 a red-letter year? It's up to you. W1ADW is back with us again. He reports the completion of remotely controlled transmitters for operation on 14,000 and 3500 kc. W1RP expects to build a low power set for traffic work on 3500 kc. He should be a new ORS when this is published. Congrats and welcome, OM. W1AVT of Torrington and W1PF of Stamford, both ORS aspirants, reported for the first time this month. W1ASD asks for temporary cancellation of his ORS until he has graduated from high school. We hope he gets Magna Cum Laude and comes back to the fold soon. W1AOI has just finished an ultra-1929 type transmitter with stroage batteries for both plate and filament of a 203A in the TP-TG circuit. He has schedules with W1VB, W3AOC, W1CTI, and W1ZL. W1IM reports his schedule with nn-1N1C a sure-fire proposition. Here's an outlet for South American traffic, gang. W1NE worked France on 3500 kc. W1AMC tried 28 mc. but was unsuccessful in hearing anyone. Try again! W1PE states that 3500 kc. noise is running very much like the racket on 7000 kc. W1BHM is on 3500 kc. A storm reduced W1ATG's 3750 kc. antenna to a mass of wreckage. He will operate on 7500 kc. until he rebuilds the antenna system. W1AFB deserves our congratulations. He made the BPL with a total of 250 messages and is resting and getting primed to question W1MK's traffic supremacy during the next month. FB. RP at W1MK leads us all with his total. In spite of some bad local power QRM, schedules run on as usual. A new set of A cells has been installed and a new receiver will follow. W1TD has not been able as yet to locate his power leak interference. W1BWM is all set for a big year. He reports W6EK R7 on 3500 kc. at 10:30 pm. FB. W1AMG's "High C" TP-TG circuit with its 852 is all ready for 1929. He reports that the gang is crazy about W1AUK's 1929 4 tube, "QST" receiver. W1OS is rebuilding. W1BI-1BQH reports that things are "dead as nails." W1BNS worked EF, EG, FM, FF and a French ship off West Africa. W1IV is all ready for 1929 operation with an absolutely clickless transmitter using a UX210. He is still busy at WEAF and will have to operate intermittently. W1VE is abut to embark upon a commercial career. He will start at the RCA school the first of the year and expects to do his operating at commercial stations in the future. Good luck, OM. W1ZL was heard in England on 28 mc. The SCM is now on 3500 kc. and will be on the air every night but Monday and Thursday. W1CTI will soon have an announcement for us in regard to the Traffic Night he is planning. W1ZZA is doing splendid work on 14,000 and 7000 kc. In closing the SCM wants to wish all of you the happiest and most prosperous of New Years. He is deeply grateful to you all for your greetings.

Traffic: W1MK 565, W1VE 14, W1BNS 40, W1AMG 37, W1BWM 55, W1TD 3, W1AFB 250, W1ATG 6, W1BHM 42, W1PE 128, W1AMC 17, W1NE 64, W1IM 44, W1PF 38, W1AVT 7, W1RP 25, W1ADW 38, W1ZZL 6, W1CTI 78.

RHODE ISLAND—SCM, C. N. Kraus, W1BCR—W1BLV is a new ORS and makes the BPL. W1BQD reports handling Byrd Expedition traffic. W1AWE was QSO a ship in the Indian Ocean. W1BCR wants to QSO local amateurs on 3500 kc. fone. W1AFS is a new ham as is W1CPH. W1NO is back on again. R.I. traffic meetings held every third Monday in the Engineering Bldg., at Brown Univ. Like to see more fellows attend. Meetings of the Radio Club of Rhode Island are held regularly every Monday from 7:30-10:00. Good speakers twice a month. Through W1BCR, code practice is transmitted every Wednesday from 7:00 to 7:30 pm on 3530 kc. Announcements are made on fone. Anyone interested in joining the club or in getting the code practice, write G. P. Hefler, Secy, 193 Whitmarsh St., Providence, R. I. Membership in the club is not required to attend these meetings. Official Broadcasts are read on fone at 7:30 Wednesdays following the code practice.

Traffic: W1BLV 110, W1BQD 17, W1MO 16, W1BCR 15.

NEW HAMPSHIRE—SCM, V. W. Hodge, W1ATJ—W1IP's new transmitter is going and he has already blown one tube. He is now using a 210 and handled a bunch of traffic. Hard luck couldn't keep W1AEF off the air for long. He is back again with a 1929 signal. FB. W1BFT handled a few in spite of a lot of outside work. W1AUE is trying 14,000 kc. W1COW is organizing a club at Phillips Exeter Academy. W1AVJ has joined the Naval Reserve. W1AUY is getting out well with fone and is applying for ORS. W1ANS is operating on 3500. W1MS is on 14,000 and is experimenting with 28 mc. W1JN sent in a report. W1ANK will be on soon. Listen for the ARRL broadcasts from W1ATJ Mon., Wed., Fr.i at 6:30 pm on 3950 kc.

Traffic: W1IP 126, W1ATJ 78, W1AEF 71, W1AUE 44, W1AVJ 20, W1ANS 15, W1COW 13, W1MS 8, W1JN 4.

MAINE—SCM, Fred Best, W1BIG—W1BEA, a newcomer to Maine traffic ranks, leads all of us. Sort of

a dark horse, as it were. Good work, John, OM. W1ANH ran a close second and enters the BPL in a blaze of glory, in spite of deliveries. Hi. A fine total, Harry, and keep up the good work. W1BIG ran third this time. Competition is stiff and the SCM does well to run as close to the top as this. W1AUR turned in a mighty fine total. He is a real RM, like W1ANH, and is setting a fine example for the members of this Section of the state. Schedules, which are kept regularly, are the secret. W1CDX trails W1AUR slightly this month. However, the RM of southern Maine is very much in the race and his total is very FB. W1ACV of Houlton is striving again for an ORS certificate. He sent in a fine total which puts him in a position to claim this coveted honor. Mrs. W1AJC is doing good relay work in Portland, as her total testifies. She led the OM by quite some traffic but then, as she says, she has more time for such purposes. W1AQD sent in his usual fine total. He is all equipped for Official Observer work in 1929 and looks forward with interest to making some QSO's on the 5 meter band which he is now interested in. W1AUS has a big set doing its stuff. Two 500 watt bottles with a real plate supply. As he bothers the BCLs, he cannot work until after quiet hours. Watch his total now, gang. W1AQL, RM of eastern Maine, has been on the job and his report on RM work shows that the hams in his Section of the state are on their toes and raring for traffic. Good work, Brownie. W1AHY has received his ORS certificate and his fine total testifies to the good work he has been doing in traffic lines. W1BFZ has come up to the traffic band from 14 mc. once more. Welcome, Mel. Mr. W1AJC manages to squeeze in a good total in spite of the fact that Mrs. W1AJC works the set to the limit. Hi. It is a pleasure to work them both, gang, and you will find them on 7142 kc. W1KQ has been sojourning on 14 mc. during the past few weeks and has forsaken 3500. It happens to all of us, Lester, so just hurry back and join the gang on 3500 kc. W1COV is about to receive an ORS appointment. He has made the necessary reports and questionnaires will be forwarded him soon. W1ART reported by radio, turning in an extra fine total which makes him eligible for an ORS appointment. Fine work, Sis. The Queen City Radio Club regrets to announce the death of Mr. Ray Mahoney, W1AVQ. Members of the Club acted as pall bearers, and sent a floral tribute. The death of Ray has left a place which will be hard to fill in this active organization, and the sympathy of the entire Section is hereby extended officially to members of the family and the Radio Club of which he was a very active member.

Traffic: W1BEA 320, W1ANH 253, W1BIG 234, W1AUR 182 W1CDX 100 W1ACV 46, W1AJC 42, W1AQD 34, W1AUS 32, W1AQL 29, W1AHY 26, W1BFZ 22, W1AJC 20, W1KQ 14, W1COV 12, W1ART 197, W1BBE 19.

WESTERN MASSACHUSETTS—SCM, J. A. Tessmer, W1UM—The Worcester Radio Asociation will hold regular meetings every Thursday at its club rooms 274 Main St., room 301.Anyone desiring to keep in touch with amateur radio is welcome to attend the talks and to enjoy the facilities of the club. The grid receiver that worked at once belongs to W1GR and not to W1DR as erroneously printed in *QST*. W1AMZ has joined the U.S.N.R.W1BKM is looking for schedules north and east. W1BVR is rebuilding for 1929 results. W1ADO has just finished a 4-tube screen grid and is building an ultra-fludion xmitter for 14 mc. and 7000 kc. Stations W1BKM, W1ANH, W8ARX, W1AU and W1AAW are commended for their fine cooperation in handling the traffic resulting from the radio show at Springfield. W1APL, due to unstated reasons, will be off the air for four or five months. W1BNY is also looking for schedules. The Worcester gang would like to visit W1BGM but is only waiting for an invitation. He sure is handing in a nice report of messages, handling 158. Watch him, fellows. It looks like he will make the BPL. Sure fine work for a non-ORS. W1ASU active on 14 mc. The Worcester Radio Assn. believes that Mr. Ross Hull deserves considerably more credit for his new circuit than the gang is giving him. W1BKQ is worried about how and what to build for 1929. W1UM says there are plenty of form 1 cards. How many?

Traffic: W1BKM 44, W1EO 11, W1ADO 9, W1BWY 91, W1BGM 158, W1AMZ 21, W1AJK 4, W1ASU 10.

EASTERN MASSACHUSETTS—SCM, E. L. Battey, W1UE-W1ACH is high traffic man this month. W1KY and W1BOB make the BPL on deliveries. W1RL has applied for ORS. W1BOB also applied but he is leaving for South America with the scouting fleet so appointment will not be made until after his return in June. W1NK made Radioman 1st in the Reserves. FB. W1CQ has been QRW with BCLs but is going to start up with a bang the first of the year. W1AGP is making a crystal-controlled outfit for 1929. W1BLD is entering Northeastern University so we will not hear his signals much longer. W1ARS will soon have his ORS. W1KY suggests an ORS meeting for discussion of our mutual problems—how many would like that? KY is keeping schedules on 3500 and says QRM is getting bad up there from off-wave fones—hope they are not in our section, YL. W1ACH handled a message to Gov. Fuller. W1KH did some nice relay work between a girl in France and her mother in Boston—they talked over an hour via W1KH and EF-8BTR. Very FB. W1BIX is busy with some sort of Sales drive so no radio for awhile. W8JQ of Pittsburgh is teaching Latin at the Quincy High School and made a visit to W1UE. He will be visiting more hams soon. Traffic between N. Y. and Boston moves fast over W1AAW-W2BGO route. W1APK is working at WLEX and W1XAY—he has new 50 watter at his own station. That wonder tube at W1RY was two years old on Dec. 27th and still hooks DX. RY has now worked 40 countries. Reports received from W1LM, W1ABA and W-ASI. W1BFT is rebuilding. W1AZE says no OZ's or AO's coming through. W1WV finds it necessary to cancel all skeds because they are taking too much time. He also thinks DX is gone forever. We hope not, OM. W1BVL has new transmitter, which he is testing out. W1CPB and W1IA are struggling with new receivers—the SCM listened on one of them which was very FB. W1BDT is on the air again with same old punch. An old timer, Eddie Gallagher, of Atlantic is on with call W1PK. W1BZ is also on again with fone on 3530 kc. Because of inactivity and failure to report, several ORS will be cancelled before next report—we do not like to do this, but inactivity only slows up the rest of the section. Write your SCM a letter now and then with suggestions for bettering this section.

Traffic: W1ACH 240, W1LM 168, W1AAW 136, W1BOB 129, W1CQ 107, W1BLD 85, W1KY 94, W1WV 54, W1AZE 50, W1ASI 47, W1KH 41, W1ARS 24, W1UE 15, W1BBT 9, W1RY 8, W1ABA 7, W1BIX 3.

VERMONT—SCM, C. A. Pauletter, W1IT—W1CGX is still holding the high place in this state this month. Come on, fellows, and give him a run for his money and there is going to be a traffic race with a prize for the high man to come off soon. This will be announced through our state broadcast from W1AJG and will be announced every broadcast when it is to start, so keep watch. Thanks, W1ATZ, for the report, this month, and wish more of you fellows who are not OSR would report, as it helps the section out and makes news for all. Hope to hear you regularly. Chas. OB (W1AJG). We miss you on the air this winter. Know you are very QRW, W1BJP, so hope you get a chance fo rsome schedules anyway this winter. Sorry Don. OB, W1AOO, you have been sick. Hope you get to pounding brass again soon. Say, W1BCK, OB, hope you will get 1BCK on the air soon as we miss you very much and need the traffic in this state. Say, OBs, who are ORS, please come across with your reports and help me out only 6 out of 14 ORS reporting this month. Here goes for 1929—let's make it a banner year—what say? 73 to all.

Traffic: W1ATZ 22, W1BCK 4, W1AOO 47, W1BJP 17, W1AJG 22, W1CGX 140, W1IT 28.

NORTHWESTERN DIVISION

ALASKA—SCM, W. D. Wilson, WWDN—A radio report from K7TO, coming via W7AF and W8BBP, gives us a total of 32 messages for December. The rest of the report comes via W7TX with the report from Washington. K7ABE has a real total and makes the BPL. K7AER, K7AEL and K7ANM are also doing their shares. K7ANM is a newcomer in Kodiak. K7TE had the misfortune to lose his lighting plant through fire but will carry on with B batteries.

Traffic: K7ABE 210, K7TO 32.

OREGON—SCM, R. H. Wright, W7PP—W7IQ now has a 7½ watt crystal set on 7000 kc. W7MQ and W7RJ both manage to keep their 203's warm on 7000 kc. W7KR is experimenting with high "C" and will be on soon. W7DP and W7BO are on consistently both on 7000 and 3500 kc. W7HG and W7VC are using 201A's with 250 volts of B batteries. W7PL is getting a surprisingly low amount of current on the plate for the voltage used. he is operating a 204A with a mercury arc. W7LT found 6 mikes of filter in his stocking Xmas morning. W7WR has moved his set to another shack—he is open for morning skeds North. W7PE gets pure

D.C. reports on his signals, he is using a high "C" tank circuit but has no filter.

Traffic: W7PL 82, W7UN 72, W7AMQ 41, W7PE 37, W7MV 21, W7LT 13, W7WR 7, W7GQ 7, W7SI 5.

WASHINGTON—SCM, Otto Johnson, W7FD—Waskey, W7TX, continues to lead in Washington. He handles practically all the Alaskan traffic. FB, John. "Helgy," W7AIB, is in the Coast Guard but finds time to operate W7AIB as well as NAG. W7AAE, W7ACE, W7ACS and W7KT keep Tacoma on the air. W7TJ, W7WI, W7UI and W7VL do the same for Spokane. Activity in Southern and Southwestern Washington is picking up. W7BM has resigned his RM and ORS offices. Hurry back, Art. W7ACS is a new OBS. W7GP in Olympia reports much grief with xtal control. W7VL ditto with M.O. Seattle stations are getting on the air in with BCL's and R.I.'s. Hi. All amateurs are warned to note the expiration date on their licenses as many tickets are being cancelled due to failure to renew in time.

Traffic: W7TX 82, W7AIB 48, W7AAE 43, W7OV 30, W7ACS 27, W7GP 26, W7LZ 20, W7FD 19, W7ACA 13, W7WI 12, W7TJ 9, W7KT 6, W7UI 5, W7AOG 5, W7VL 3, W7AF 29.

IDAHO—SCM, James L. Young, W7ACN-W7JL—The holidays slowed up the Idaho gang some. W7AJQ, W7AKZ and W7ACN were all off on account of Xmas rushes. W7AKZ is the new call of W7AGT who didn't renew his license soon enough. The W7ALW twins seem to be hitting the ether FB. W7YA is on regularly during school hours and Wednesday evenings. W7ABB is taking post-graduate work in high school, besides holding down a position in the weather bureau, and pounding brass. W7GU was busy selling BCL sets. W7IY is on every day on 7000 and 3500 kc. and hands in a nice total regularly. W7KA (ex-9BAD) is on with a new outfit and is getting out fine. W7HE is on quite a bit and seems to think that the beginner is the ham's disinterested son. Cheer up, OM, t'isn't so. W7ACP is getting on as soon as time and his pay check will allow him to. W7ACD has finished a new shack and is now rebuilding his equipment throughout. W7CJ has been on quite a bit, prior to pulling up stakes and moving back to Summit. He has to rebuild for a new power supply, as he is losing AC service. Stations are being rebuilt, new antennas strung, better receivers being built, and new Q signals being learned to meet the requirements of the new bands and conditions.

Traffic: W7IY 55, W7YA 35, W7KA 32, W7ALW 14, W7CJ 14, W7ACN 13, W7ACD 7.

MONTANA—SCM, O. W. Viers, W7AAT-QT—W7EL reported although his ORS has been temporarily cancelled. Now that's REAL HAM SPIRIT!! W7HP reports all kinds of trouble building a decent 1929 transmitter. W7DD is too busy with construction work to handle much traffic. W7JC may soon leave for points east. Sorry, ED, OB! W7FL wasn't on much but worked W1BEA. W7ZU and family were down with the flu. W7AAT handled a few. He had a misfortune, breaking his mercury are the first time it was hooked up.

Traffic: W7AAT 102, W7HP 40, W7DD 32, W7EL 10, W7FL 2.

PACIFIC DIVISION

PHILIPPINES—Acting SCM, Jose. E. Jiminez, K1AT—Lieut. Bicher, K1HR, reports a fine total this month. Schedules are kept with ac WUQ Tientsin, China, at 5:30 p.m. daily; ac8ZW, Shanghai Observatory, China at 6 p.m. daily K1RC, Radio School, Cavite, P.I., at 8 p.m. daily; W6BJX, Los Angeles, Calif., at 11 p.m. Thursday. Traffic for the following countries can be handled through K1HR: United States, Hawaii, Malay States, Dutch East Indies and China.

Traffic: K1HR 1203.

LOS ANGELES—SCM, D. C. Wallace, W6AM—Three stations make the BPL this month, W6CHA, W6ZBJ and W6BZR. Forty-three stations report this month with thirty-seven handling traffic. The holiday season evidently boosted traffic totals. W6CHA says it sure is FB to be a ham around Xmas time. He should have been credited with 674 instead of 274 messages as given in the BPL in November *QST*. A garbled message was responsible for the error. Fox Studio gang is now at Tahiti (OOBAM) taking movies and he handles a bunch of traffic from the fellows down there. W6ZBJ just put up a new Zepp and reports are FB. W6BZR thinks he broke a record for daylight QSO on 7000 kc. He was QSO K6DJU at 5:58 pm OST on 12/2/28 and it was only 3:15 there. Got R5 from him and give him a message, which he got OK the first time. W6DKV just got word that Hoover of ex-OH6DEY will be here to visit the hams. W6DKV wants some reliable skeds. W6EGH handled messages from NN, NC, OH, OP, AJ, OZ. W6DSG was R8 on east coast twice. W6UJ reports his remote control over fone company wires from office to house is still working FB. W6AXE is one of our new ORS who sends in a good total and is becoming very active. On Jan. 1, he took a msg. from W4CI via W6DTP for the sport announcer, Mr. Bill Mundy of Atlanta, at 10:30 am and delivered the message at the Pasadena Rose Bowl at 11:20 am or 50 minutes after he received it. W6BJX reports that the new president of the Short Wave Club of Pasadena is T. E. Nikirk, W6KA, old timer of spark days. W6BJX has his 852 running at normal millsviz 75, with 2000 volts on plate. W6EEB installed remote control. FB. W6BYJ is rebuilding and QRW with work. W6DOW was QSO W5EA on 28 mc. W6AGR was QSO all districts of USA in two hours and fifteen minutes. W6AGR has kept a perfectly good sig on the air for two years or more, and is still going strong has logged over 4000 QSO's in that time. He has not missed turning in a report since he has had his ORS certificate. W6DHM is having a hard time to organize a transcontinental route. He needs some more stations. W6OF reports that it has been snowing up there, and the radio shack is pretty cold, but he sends in a good report just the same. W6AKW has a new wavemeter and if he can help any hams spot themselves, he shall be glad to hear from locals in mornings and DX in evening. W6AKD is having very good luck with 28 mc. W6AWY is now using an 852 with 2200 volts on the plate thru a pair of rectobulbs. He reports DX not so hot and conditions dead on 7000 lately. He is going to try 14 mc. soon. W6APW has been building 1929 transmitter and receiver. W6HT says his traffic total is low this month on account of pushing Day-Fan radios. He expects to be on the air by 1929 with crystal controlled outfit. W6DLI has been at sea at San Clemente Island for two weeks and now has portable call so will be on the air all the time.

W6AM is on 28 mc. on Sundays and holidays, many stations QSO. Six were QSO one Sunday and seven stations QSO the next. The usual DX and QSO's on 7200. W6DNF has been busy rebuilding and getting ready for 1929. W6EKN sends in a nice report as his first one. W6DOW reports that DX has been rather scarce lately, but he is looking for it to pick up along the middle of January. He is bothered by a power leak from two 60,000 volt lines about 150 feet away. W6DKX kept his regular schedules for USDA network. He also announces with some pride that he now has a two letter call, W6HS. W6ALR sends in a good total as usual. He is another of our good steady ORS and has opened up a radio store in Fresno. W6DZI hopes to have some good schedules very soon W6EKC had the flu for a while but sends in a good total, anyway. W6DHR is putting up a new Zepp antenna. W6BVM just returned from a trip East. W6CUH has heard 25 stations so far on 28 mc. W6AOS reports his CX310 went west from trying Ulta audio circuits out but he got another 7½ and is going strong with old Hartley circuit. W6COT says his A bats went west. W6BGC managed to get 250 warmed up a few evenings this month as KFSG's evening hours have been cut to 3 evenings per week. W6CZT reports as usual. W6DGT is now on 3500 kc. going strong after trying 14 mc. and 7000 kc. Says 3500 has a swell bunch of ops. W6BRO cancelled all his schedules, only for the month of December, we hope. He is still rebuilding and is just recovering from a bad flu attack. W6DLK went to see W6DNH at the Sanitorium but got kicked out as the place is under quarantine. W6OF is working out a remote control system so that he can operate his set from the house, as the shack is plenty cold. W6ASM has been very busy with club work. W6QF has been back in Washington meeting with the Radio Commission. W6QF is president of the Amateur Radio Research Club of Los Angeles, one of the liveliest clubs in the Los Angeles section. W6DEG says that he has been plenty busy this month, making short wave receivers for the BCL's.

The Associated Radio Amateurs of Long Beach now have a permanent meeting place. It is the City Council Chamber at the City Hall, at 7:30 each Friday evening. They are having a beginner's code class which is not limited to the members of the A.R.A. The A.R.A. put on the last Section quarterly banquet, which is reported elsewhere. About 15 members of the club visited one of the meetings of the High Frequency Club of Arcadia, held at the C. of C. Bldg. in El Monte, and this was reported to be a very interesting meeting. W6ANN on 28 mc. was

QSO W1CCZ, W2TP, W5OM, W2NM, and heard ZL2AC. W6DMT's relatives sent out cards in some envelopes that W6DMT had had addressed for Christmas cards, but he never got to send them. W6DMT crossed the Great Divide December 9th.

Traffic: W6CHA 719, W6ZBJ 210, W6DKV 168, W6FT 133, W6EGH 106, W6BZR 84, W6DSG 70, W6UJ 51, W6AXE 44, W6BJX 42, W6EEB 38, W6DYJ 37, W6ABK 36, W6AGR 35, W6DHM 34, W6OF 34, W6AKW 31, W6AKD 25, W6AWY 25, W6APW 24, W6HT 23, W6DLI 23, W6AM 20, W6DNF 19, W6EKN 18, W6DOW 18, W6DKX 16, W6ALR 15, W6DZI 14, W6EKC 14, W6DHR 11, W6BVM 9, W6CUH 9, W6AOS 8, W6COT 3, W6BGC 2, W6CZT 2.

EAST BAY—SCM, J. Walter Frates, W6CZR—The section ran up what is probably the greatest traffic total in its history during the past month in an effort to give the Los Angeles section some competition in the inter-section contest this year. W6ASJ and Houston of W6SR were responsible for most of the messages. The former requested employees and fellow workers to contribute at least one message apiece and secured a deluge of traffic. Houston convinced a chain store concern to allow him to get messages from its hundreds of employees and got a stack a foot thick for all sections of the world. W6IP and W6ALX and the other traffic handlers in the section attended to QSRing the mountain of QTC's and got them out before the Christmas holidays. In addition the Oakland Radio Club divided its membership into two competing traffic teams under the capacity of W6ASJ and W6CGM and they sprang into the ether burning with great enthusiasm. The contest between these teams will run for the next two months and prizes will be awarded by the section and the club. Other messages were secured by the individual operators themselves and some were phoned in by BCLs after an announcement of the contest over the air from KTAB by Dr. Herrold. W6IP has gone off the air after running up the lead total for the section in order to rebuild for the new bands. W6ALX is doing likewise, but is also maintaining a sked with Salt Lake in the day time. W6BSB had to discontinue his traffic work due to his marriage and subsequent departure for Minnesota on a honeymoon. W6EMI says that while he is off the air this month, he is going to build his new station in true 1929 style with screen grid receiver and everything. W6IM says he has been very QRW with work but manages to pound a little brass at W6CTX's shack. W6ASJ thinks he will go to 3500 kc. and try traffic work there with possibly short excursions down to the new 7000 kc. band. W6EDR still pounds away on law power and W6EMD is making his debut as a traffic handler. W6RJ opened up again during the past month with two UX210's on the 3500 kc. band with Heising modulation for phone work. W6HJ still complains that the doldrums has hit his shack and that he praying for the return of summer and some real DX. Houston of W6SR is working east cast nightly on 7000 kc. with a high capacity transmitter a la Ross Hull and says it is the berries. Old W6CMG is back in the game again and is handling traffic from P.I. W6BPC has been very QRW working a weekly Alaska sked with K7ANS and changing his big 250 watt transmitter over for the new bands. W6CTX still holds his Jap skeds and says he handled traffic for KFWM tests and did plenty of Boy Scout work. W6BYS is a new man in Napa who is coming into the traffic game in FB shape. W6BUX at Angwin says he is going to high power for the new year and has two ops coming up, one a YL. W6CLZ was back on 14 mc. band during the Xmas holidays and held a sked with AP1. W6DUR is on with a 15 watt Hartley and says he handled death messages on Xmas day, delivered them, and sent two answers back within half an hour. Great stuff. W6EDK is rapping out the traffic with a series of central California skeds as well as sending his regular broadcasts. W6CGM still getting some traffic from P.I. with his new Ultraudion and relays the greetings of W6NO from the Orient. W6DDQ, RM for northern part of section, is doing good work and handling traffic. He got one msg. to destination and back in 15 minutes. The section sure delivers. W6BMS says his transmitter is all set for new year and is pretty neat. W6BFO is making himself a great QSR point for Hawaii. W6BI installing new xmitter so can cover 7000 and 3500 kc. band for Naval Reserve and ham work and says next month will have 100 or bust. W6ENV says he is bothered with local QRM but is doing some traffic. W6DWI is giving the leaders a run as traffic man. W6BZU still sending boiler-plate fist into the interior countries with QTC's. W6EDX comes in this month with a nice total. W6CZR is very QRW with personal business and rebuilding for himself and OW who is coming on the air soon under her own call of W6ARU. The fellows in the section were very downcast this month to hear of the sudden death of Pepper, W6DMT, of San Francisco, a real ham, who was a frequent visitor in the section and who had a wide circle of friends. The Oakland Radio Club held its annual Xmas party at W6CZR with Houston of W6SR acting as Santa Claus. The club elected the following new officers: Jact Tait, W6IT, president; Freed Windmuller, W6DCZ, secretary-treasurer; W. A. Hammond, W6ALX, publicity manager; Murray Douglas, W6CUG, chief operator; W. S. Upson, W6IP, chairman of the house committee, and W6CZR, W6BFO, W6AOJ, W6ASJ and W6BJW board of directors.

Traffic: W6IP 734, W6SR 577, W6ASJ 435, W6ALX 419, W6DWI 233, W6CGM 226, W6EDK 119, W6BSB 111, W6BYS 87, W6BZU 78, W6BFO 78, W6CTX 75, W6EDX 73, W6EMD 64, W6BPC 36, W6RJ 33, W6DUR 32, W6AWF 31, W6DDQ 29, W6CMG 18, W6ENV 17, W6IM 14, W6BMS 13, W6BI 9, W6CZR 8, W6CLZ 8, W6EDR 8, W6HJ 5, W6EMI 5.

SANTA CLARA VALLEY—SCM, F. J. Quement, W6NX—with over 1100 messages to and from the Philippines, and 320 of them delivered, Bruce Stone, W6AMM, turned in his best report since he started his daily sked with op1HR nearly three years ago. It is regretted, however, that this is the last month that W6AMM will contact daily with 1HR. Due to heavy school work, W6AMM has cut his sked down to two days a week. W6BMW with another station yet to be picked will endeavor to take care of the remainder of the week. With this arrangement, the famous op1HR sked will remain in the SCV section. Geo. Call, W6BHY, maintained his sked with W9COS and ran up second high for traffic in the section. W6BYH is joining the USNR communication section this month, commanded by Lt. Beall, W6BVY. W6JU received WAC certificate this month and said document already framed and on display. W6BMW was busy getting ready for 1929 operation this month. W6BAX increased his power to an 852 this month and crystal controlled. W6BNH is being operated by ex-CZFR5. W6AZS was on the air during Xmas vacation and has decided to make 14,630 kc. his permanent QRH.

Traffic: W6AMM 1102, W6BHY 149, W6BYH 65, W6JU 28, W6BMW 18, W6BAX 6, W6NX 4.

SAN FRANCISCO—SCM, C. F. Bane, W6WB—W6AC leads the section this month. W6CHL is contemplating installing higher power, also building new shield grid receiver. W6DPF, a new ORS, is also building new shield grid receiver but is afraid to change his transmitter lest he ruin that beautiful Xtal note. W6WN finally got his rig on the air. Very pretty job and we expect great things from Art this coming year. It is with deep regret that we record the passing of W6DMT, better known to his friends as "Pep". A splendid chap—beloved by all—a great loss to his folks and his countless friends. W6PW is now cutting loose with a new xmitter and promises great things for "29". W6VR and the SCM got together to build the "29" job at W6WB. Pat threatens to come on with a new job as soon as conditions improve. It is noticeable in this section that the practice of using a raw AC, instead of becoming obsolete, is now getting worse. That sort of thing is "out", fellows. Let's have RAC at least. W6DYB, a prospective ORS, is getting out in fine shape and is right after the old traffic. W6DDN has left us to invade the wilds of Los Angeles. Careful of the Indians, OB. Hi W6CWJ has great DC and plans great things for the coming year. W6AC another prospective ORS, reports things looking brighter with the new receiver. "AC" is an old timer and should be an excellent addition. W6BIA has a severe case of YLitis. There are some fine signals in evidence and 28 mc. activity is increasing but traffic is not so good. Let's do better next month.

Traffic: W6AC 25, W6DYB 14, W6WN 10, W6WB 7, W6KJ 6.

SAN DIEGO—SCM, G. A. Sears, W6BQ—W6BAM with his four schedules on 3500 kc. leads in traffic. He has added a filter system and is now heard with a DC note. W6BQ working three schedules now, and completes a chain from Tacoma to New York. W6AJM is building a new crystal control transmitter which he hopes to have going on all bands soon. W6BGL reports a good total this month. W6BVX sends in his

first report with a good total. He is handling traffic from the Philippines. W6AKQ is home from sea, and sends in his report as usual. W6EQJ ex-W2EV sends us a nice report. We are glad to have you with us in this section, OM. W6BVD reports receiving a card from Russia. W6CTP has applied for an ORS again and sends in his report. W6EPZ, a new station with low power reports for the first time this month. We are glad to have a report from any station in the section handling traffic. W6CNK has started some 28mc. work. He has been ill with the flu, but we are glad to report his recovery. W6BFE reports not much doing. We understand he has a new 852 which will soon be heard. A hamfest was held at the home of W6AD on the night of December 29. Those present included W6BPY, W6CQW, W6ANC, W6QA, W6EFD, W6EPF and W6AD. After a wonderful banquet furnished by Mrs. W6KD, discussions were held on the subjects of the new QSA system, the status of the new bands, screen grid receivers, etc. It is understood that resolutions were passed condemning the use of anything but well-filtered RAC or DC for plate supply. Everybody present agreed to work only those stations that meet the above requirements. A few of the gang forgot to mail their reports on the twenty-fifth. All ORS not reporting three consecutive months must be cancelled under the rules. If you want to keep that ORS certificate, mail your reports whether you have business to report or not. Your SCM wishes to take this opportunity of thanking you all for the support you have given him in his efforts to build up the San Diego Section and to wish you all a very happy and prosperous New Year.

Traffic: W6BAM 293, W6BQ 157, W6AJM 70, W6BGL 50, W6BVX 43, W6AKQ 18, W6EQJ 16, W6BZD 17, W6CTP 14, W5EPZ 8, W6CNK 4, W6BFE 2.

SACRAMENTO VALLEY—SCM, C. F. Mason, W6CBS –Business is picking up now. Four stations reported.

Traffic: W6DVD 2, W6BDX 15, W6EEO 90, W6DON 104.

ARIZONA—SCM, D. B. Lamb, W6ANO—W6BWS started the New Year right by rebuilding to a TPTG circuit. Says it works BF. W9EH and W6CCL are the other ops there. W6CDU has been very QRW service work on BCL sets so very little chance to do any oping. He still uses the MO set which kicks fine. W6EAA has been trying push-pull circuit. Does not seem to be as good as Hartley. W6DTU reports being on the air pretty consistently. W6ANO is making an xmitter that will work on all bands. W6BJF put in 281's for rectifier. He is working on 3500 kc. pretty regularly. W6SW is on the air yet and seems to be doing pretty good work.

Traffic: W6EAA 7, W6CDU 15, W6BWS 37, W6DTU 14, W6ANO 90.

HAWAII—SCM, F. L. Fullaway, K6CFQ—Many amateurs promise to be on after the New Year. A new ham, Nichols, will be on in several weeks with a fifty. Many of the hams were praying for their masts in our late windstorm, which reached a velocity of over fifty miles per hour. K6CFQ lost his pole so is going to use a sky hook for a while. K6AVL handled the most traffic by keeping schedules with KDV4, W5AIN and W6DQV. He may be made an official army S-W station which means he will get lots of army traffic. K6DQQ is the postmaster in Wailuku and says that Santa sure QRMs his working the key. He expects to be on with DC and a Zepp after the first of the year. K6DJU has been on a two months' radio vacation, i.e. has been off the air. Has built a push-pull xmitter and says it's good stuff. He worked Japan with a 201-A xmitter. K6DCU is still studying for West Point. Has put up a new antenna.

Traffic: K6AVL 99, K6DQQ 61, K6DJU 42, K6CLJ 25.

ROANOKE DIVISION

VIRGINIA—SCM, J. F. Wohlford, W3CA—W3TN is going to sea again. W3JT still off air QRW bank job. W3II is suffering from YLitis. W3KU visited GC6NX while overseas to get card due W3WM. He finds that CG6NX is blind. W3AAJ is back off the road and will operate his ham station while looking after WRVA. His is taking over the job that W3OM held. W3AIS has had QRM from repairing BCL sets. W3HY tried to get on 3500 kc. but could not get antenna right so went to 14 mc. and worked SP. W3AKM is busy working on BCL receivers. W3CKL shattered his 38.1 crystal. Visited at W8DFC and hammed around some. W3BZ reports nothing new at that station. W3CA has a sked with W3ZF and W4FX.

Traffic: W3ALS 54, W3CKL 105, W3HY 6, W3CA 16.

WEST VIRGINIA—SCM, C. S. Hoffman, Jr., W8HD—W8ALG leads the state this month in traffic, W8CLQ coming second. W8ALG is getting some fine DX reports from his 212-D. W8DPO besides handling a good volume of traffic worked xOOJA, nzKFR6, ys1NN, besides UG and GC. W8APN got a card from China. W8DFC has skeds with W3CKL and W1CDG. W8DNN is going on phone. W8CDV is on when not busy with school. W8OK is on 3500 kc. Listen for OBS schedules from W8HD on 7142 kc. W8DCM is on a trip to New Orleans. W8APN is at WMMN. W4KF, ex8ARN of Wheeling, here for holidays and entered into the fifth stage of amateur radio. Hi. Old W8ARN is operating WMBR at Tampa, Florida where he will locate permanently. W8HD wishes to heartily thank the hams with whom he has come in contact either personally or through correspondence during the several years of his administration. I wish to especially commend those who have been consistent in reporting. It has been quite an inspiration to become acquainted with you fellows, and I hope our associatons will be continued through the future by occasional letters. I hope you will give the same cooperation to W8VZ, the succeeding SCM.

Traffic: W8ALG 213, W8CLQ 150, W8DPO 51, W8DFC 18, W8APN 15, W8CDV 2.

NORTH CAROLINA—SCM, Enno Schuelke, W4SJ —Old Man Flu has put some of the fellows temporarily on the shelf. Colder weather is here now and it looks like this might help to perk things up some down in the Old North State. W4OC, who has been off the air most of this month because of flu, nevertheless leads the gang according to last reports. Close after him are W4TS and W4AEW with 17 each. Not so big, but then Hall is rebuilding and John was not on the air but about three days. W4AB got back from school and dusted the cobwebs off the MOPA and let 'er ride. He hopes to be able to report big totals for these holidays. W4AEH is still experimenting with antennas and claims some wonderful things for the Hertz; Here's hoping he has found something which will stay put. W4AFW and W4AGG are in a queer locality in Oxford. They report no sigs after nine p.m. in the 7000 kc. band. Went over to pay these fellows a visit and really was impressed with the kick those fellows get out of their sets. Both of these fellows appreciate a little help from some of you old timers. W4HV is busy installing BCL sets.

Traffic: W4OC 26, W4AEW 17, W4TS 17, W4AB 13, W4AEH 8, W4AFW 8, W4SJ 3, W4HV 2.

ROCKY MOUNTAIN DIVISION

COLORADO—SCM, C. R. Stedman, W9CAA—The SCM wants to thank the many hams who sent him cards of holiday greeting this season and assure you that they were appreciated. Several of the gang have been rebuilding their sets, three Denver hams including W9CAA and W9DKM have been experimenting on 28mc. and W9BQO is trying to work a High C circuit using No. 12 copper wire with a 250 watter at full power. The Fire Department is ready to make a fast run if he pushes the key very much. W9DKM has been laid up sick and during convalescence has been on considerably. He is now in first class running order. W9CNL is buying up all the spare equipment he can lay his hands on, and the Denver gang are wondering what's up. W9DUX sold out but we hope it isn't for good. W9CJC says he may go up to 3500 kc. W9EAM is on 7000 and 3500 as usual. W9CSR is still holding 14 mc. down and keeps a schedule with W8CCW. W9FQB is in a doubtful position at present, and it will soon be known if the station is to remain on the air or be superceded by two hard-studying ops at college. W9EUR thought it might help his set to get out if he sprinkled it with water. At any rate he will soon be on the air again. W9CCM is still too busy with the OMs and romance to be on much altho her fist has been heard at irregular intervals. W9FPZ says he shot a tube in his receiver and for some reason or other the set didn't work as it should following this event. He is sort of itching to try fone on 1750 kc. W9CAA is thinking about the same thing and has been oping some on the wave with CW, as well as on 3500, 7000, 14 mc. and 28 mc. and says he newly remodeled set works FB on all of the bands. W9CDE is not having

much luck on 14 mc. and 7000 kc. just now but 3500 is OK, he says. W9DNY, W9DGJ and W9ESA are quite active on the air lately. W9CDW is still QRW school but on some nevertheless.

Traffic: W9CAA 32, W9CDE 27, W9ERN 80, W9EUR 15, W9FQB 8, W9DGJ 3, W9DKM 3.

UTAH-WYOMING—SCM, P. N. James, W6BAJ—Several of the fellows neglected to report this month but reports were received from several non-ORS who have not been reporting. W6DPO leads the Section this month by way of making up for last month. He was too busy to be on more than 14 days. W6DYE has found it impossible to get a steady signal from his TPTG set, so he is now rebuilding it into a master oscillator, power amplifier affair. W6DZX has been rebuilding for 1929, also. W6CNX is back on the air once again and he expects to be on the air regularly now. W6BUV was as good as his word, and is on 7000 kc. once again. W6AYL of KRP just got his license for his amateur station and handled some traffic.

Traffic: W6DPO 75, W6DYE 50, W6AYL 40, W6DZX 9, W6BAJ 6, W6CNX 4, W6BUV 2.

SOUTH-EASTERN DIVISION

ALABAMA—SCM, S. J. Bayne, W4AAQ—The new SCM wishes to thank all concerned for the honor bestowed upon him, and assures you that he will do all in his power to make of Alabama a wide-awake section. But nothing can be done without co-operation and help from each individual. W4PAU reports by radio that a live organization has been formed at Auburn. W4AQ is operated and maintained by the members of the club. W4AQW was silent during the holidays but operated at his home in Birmingham. W4JY leads the state in traffic this month. W4VC has gone into the hardware business. W4AAH is taking much interest in the U.S.N.R. work. W4AHP has built as oscillator-amplifier xmitter but complains of no antenna current. W4AHR attempted a MOPA but decided to rebuild his Hartley. W4AJR, Alabama's youngest amateur, works exclusively in the 7000 kc. band. W4AAQ maintains his schedules with W4KV and W4JY. The SCM will be glad to hear from any of the fellows who may care to write and wishes to become better acquainted with all.

Traffic: W4JY 49, W4AHR 15, W4AAQ 12, W4AHP 6, W4AJR 1.

FLORIDA—Acting SCM, E. M. Winter, W4HY—W4AGY is now ORS, using 210 in place of two 201A tubes. Visited by W4AFC and W4AGR. Miami Radio Club still hitting on all eight. W4AL reported Thanksgving Day football game at Miami. W4ACC says next report will be four times as large as present one. W4MS says be careful how you use OM as his OW is an op now. W4BL (both of 'em) are back, one gone again and other threatens to leave soon. W4TK says conditions are rotten for DX. Exchanged Xmas greeting with Cozzens of FQPM. W4AFG has applied for ORS. W4HY using Silver-Marshall screen grid receiver. So far has only blown one set of "toobs", otherwise it works fine. W4AII has five schedules, W4ACC has two and W4MS one daily, W4ABJ and W4BN have one, and W4BL three. W4AFG has a sked with W9EDW to handle Byrd expedition traffic for Florida. Until new SCM is elected, all Florida stations are asked to report to W4HY, 2144 Rosselle St., Jacksonville, by the 26th of the month.

Traffic: 4AGY 65, W4AII 60, W4ACC 52, W4MS 31, W4ABJ 26, W4BL 23, W4BN 15, W4TK 10, W4AFG 9, W4HY 7.

GA.-S.C.CUBA—SCM, H. L. Reid, W4KU—Georgia: Some of the old reliables such as W4SI and W4RN are on the air and are handling traffic. W4RN handled traffic for WFAT. W4AV reports that there are about 20 members in the Georgia Radio Club of Atlanta who are planning some good work for the future. South Carolina: W4AAM is going to come through again soon when he gets over the new thrill. Hi. Porto Rico; The fellows are coming back now with a bang. Several new stations have sprung up and "KD" is on again. More news is always appreciated and will help us along.

Traffic: W4RN 39, W4AV 7, W4KU 2.

WEST GULF DIVISION

OKLAHOMA—SCM, J. G. Morgan, W5AMO—New receivers are appearing daily and each ham swears by his particular circuit. A lot of them are using the four tube receiver, that was described in November *QST*. W5SW and W5QL both have one of these receivers and they sure are FB. W5ADV put in a pair of 281's and his sigs are sure tearing up a lot of fones now, fb, OM. W5AIR is putting in crystal control. Some activity in the Tulsa bunch flared up this month and there seem to be about 7 live ones going. W5BEE drew the short straw and had to report for the bunch. Thanks, OM, and let's hear some more from the Tulsa gang. W5ANT has a pair of 852's and plans to get both going soon and snag FO-A50. W5FJ took his transmitter home from O.U. explaining that it caused too much QRM for his education. W5APG is still using his old 203. W5QL is rebuilding his entire station. W5VH is still using the now famous 210 and says she's good for lots of traffic yet. Hi. With the coming of spring, the DX sigs should start rolling in again and maybe we can still work them from the newband, how about it, fellows? W5BAG is still rebuilding his set. Now that new conditions are to be coped with, why not write to the SCM and let him know how all you fellows are getting along in the new bands. Let's hear more from every ham that is doing anything of interest to the bunch. How?

Traffic: W5AMO 177, W5GF 26, W5VH 26, W5AIR 5, W5ANT 18, W5ADV 23, W5AYO 11, W5AFX 18, W5FJ 10.

SOUTHERN TEXAS—SCM, R. E. Franklin, W5OX—W5AQY, the station of the A. & M. college takes the lead in traffic this month and is asking for more skeds to handle traffic for the students. That's the spirit, OMs—keep it up. W5ASM comes to the front with a nice message total and is keeping several nice skeds. W5ABQ has been elected the new Route Manager of the San Antonio Radio Club. Congrats, OM. Get busy now, fellows and see him about those skeds that you need. W5NW reports hearing WFAT of the Byrd expedition consistently R6 and R7. W5LP has a couple of nice skeds, even tho his school work does require most of his time. W5HS, we are sorry to say, has been ill with the flu but is able to be about again. W5AFG has changed his QRA a few blocks and has built a nice place for the xtal control outfit he now has. W5PK writes from faraway Japan asking us to correct a misprint in the October report saying that W5KP was on the SS *Bessemer City*. It should have read W5PK. Sorry, OM. Congrats are in order for W5PO who has a brand new eight pound junior operator. FB, OM. W5AHP has just purchased one of the new "Lizzies" and consequently the ole transmitter has suffered. The SCM wishes to take this opportunity to wish each and every one of you the happiest and most fruitful New Year you have ever had.

Traffic: W5AQY 51, W5ABQ 16, W5ASM 36, W5LP 16, W5NW 16, W5HS 4, W5AHP 4.

NORTHERN TEXAS—SCM, J. H. Robinson, W5AKN—Christmas is over and I hope reports will come in better after the rush. Reception is improving and most of us should have our transmitters and receivers worked over for 1929 work by this time. Fellows, let's get on the air and work with each other. W5BBF has three schedules and sends in a nice report. W5BAD says as the football season is over, things will pick up his way. He is now keeping a schedule with W5BBC. W5BAD says he will be on the 3500 kc. band after Jan. 1. W5OE also is QSYing to the 3500 kc band. He is an active station in Ennis. W5OE reports that Amarillo has five active stations (wonder why they don't report to the SCM?) all QRV for traffic. West or east-bound traffic is best routed through W5QE, W5VD or W5APB. W5HY as usual sends in his report on time and correct, thus helping the SCM. W5ATZ, reports working a ship with the call letters XEDOZP, located in the Pacific Ocean. W5AKN-W5BG operates about three nights a week. Reception has been very good. Canadian stations have been coming through in fine shape. W5DF reports that he is busy with work in the local BCL store.

Traffic: W5BBF 46, W5BAD 33, W5APB 14 W5HY 14, W5OE 11, W5ATZ 8, W5AKN 3, W5DF 1.

CANADA

ONTARIO DIVISION

ONTARIO—SCM, E. C. Thompson, (This report came in also via radio through VE3IA & W2CUS) VE3FC—Southern Dist.:—VE3CS with two operators is again the star station, as regards traffic, but VE3IA is running him a great race for the DX honors. Both have had an exceedingly busy time with schedules on 5710 kc. and incidentally that's where the traffic is. VE3AQ had a tough break when his plate transformer went west and put him off the air for three weeks but the remaining week surely was used to advantage. VE3TM is on 7500 and 5700

kc. daily, keeping schedules on the latter frequency which means that he handles traffic. His signals are reported as very beautiful in Toronto on 5700 kc. VE3CB has been working on all four of the popular bands, including 5700 kc. His traffic and his DX are improving each month. He also reports the advent of a new station in London whose call is VE3AU. Welcome, OM, let's hear from you. Central Dist.: VE3BC cops the traffic honors this month with a very fine total, nearly all handled on 5710 kcs. He works the three popular bands and enjoys schedules and DX. VE3BL will have the 500 watt "Belgian Lantern" doing its stuff to the tune of 5000 volts from a mercury arc rectified 500 cycle supply long before this is in print, and his OBC transmissions will then be available all over Ontario etc. Much traffic has been handled and many schedules kept, on 5710 kc. at this station, during the past month. VE9AL has been active to the extent of quite a good traffic total. His work is also on 5710 kc. VE3FC is keeping schedules on 3795 kc. and also on 5700 kc., and as a result, traffic is moving. VE9BJ is on the air off and on and has handled some traffic. VE3BP has been rebuilding and trying to filter the output from a new tube rectifier so as to be ready for 1929. VE3CL has been having his troubles with a receiver which does not want to work, but he reports that the transmitter is getting out. VE3CQ is using a 201A on 5710 kc. and appears to be having good luck. VE3DA and VE3SC are heard regularly on 5700 kc. VE3BO is our local star in the DX receiving line. He has heard several Asian and African stations on 14,000 kc. VE3EQ is preparing to greet 1929 with a new transmitter and a nice pure note, and we all are rooting for him. VE3AZ is not active at present, having lost his aerial. Northern Dist.—VE3CJ is the star traffic station in the whole section, having very nearly made the BPL. "Bud" keeps 11 distinct schedules with as many stations, all on 5700 kc. and he says that the "old lantern sure earned its salt this month". We believe him for he was on EVERY night without fail. VE3ET is proud of his traffic total and he surely has a right to be. He worked hard and consistently for it on 5700 kc. as well as on the other bands. VE3AR is trying to make a new transmitter perk. VE3HP sends his last report from the North, as he is leaving early in the New Year for Dundas in Southern Ontario, where he will be heard from again by the time this gets into print. His traffic total shows that indeed he has not been idle. All of it was handled on 5710 kc. He will be missed from the northern district.

Traffic: VE3CJ 135, VE3BC 103, VE3ET 77, VE3HP 59, VE3CS 45, VE3BL 37, VE3FC 30, VE9AL 25, VE3CB 15, VE3IA 11, VE3TM 11, VE3AQ 8, VE3BO 8, VE3CL 1, VE9BJ 17, VE3DA 9.

QUEBEC DIVISION

QUEBEC—SCM, Alex Reid, VE2BE—By the time this appears in *QST*, we will be using our restricted bands. Let's hope that things will go on as usual, and that we will not suffer any great inconvenience. The SCM wishes to take the opportunity of wishing the gang a very Happy New Year. 1928 has been a prosperous year for this section. A number of new stations have been added to our list. Traffic has increased over 100% during the past twelve months, and out of eleven ORS, we never have less than six reporting. Traffic directed for this section is well taken care of, and the SCM wishes especially to congratulate the following stations for their good work during the year: VE2AC, VE2BR, VE2BB and VE2AL. The phone stations are surely coming to the fore these days; last Sunday there were five on at the same time, and some real fine signal strength was noted. VE2AD with new MO is the latest station in this class. VE2EM and VE2AM sent in their first traffic report and we are glad to add them to our list. Keep it up, boys, and get a certificate. VE2AC has been carrying on some fine experiments with his portable transmitter located in a mine 600 feet below the earth's surface, and reports transmissions and reception good. VE2AX and VE2CA are getting in some fine DX these days. VE2BE is still keeping his sked with the Byrd expedition. What is the matter, VE2BG?—have not heard from you for sometime. This also applies to VE2HV. VE2AX is now sharing his shack with VE2AN.

Traffic: VE2AC 38, VE2BE 46, VE2EM 40, VE2AM 14, VE2AL 8, VE2BR 24, VE2BB 23.

VANALTA DIVISION

ALBERTA—SCM, E. J. Taylor, VE4HA—Good old DX weather is back again and we are all taking advantage of it. VE4EY says worked nearly all U.S. districts in one night. No wonder, old chap, with that note. VE4HM rebuilt along lines of *QST* 1929 transmitter. Says best yet. VE4AH asst. operator at CJCA, moved ten miles north and is not able to get on the air much at present. VE4CU has a new location and is getting out FB. No word from VE4CL. VE4EP is on right along and reports good DX. VE4IO and VE4FF come in right along. VE4FT is still doing nice work. VE3GT is away most of the time but gets good work in Saturday nights. VE4HA is getting good results on 28 mc. He finds it almost as good as 14 mc. Before this gets into print, we will be working under our new allotments. I trust that we can keep within them. I would like to extend to all best wishes for the coming year.

Traffic: VE4HM 8, VE4HA 5, VE4EP 2.

BRITISH COLUMBIA—SCM, E. S. Brooks, VE5BJ—VE5BR maintains skeds with VE5AL and W7KO. VE5GO is using Hull 1929 design receiver and TPTG transmitter. Says both sets are working FB and expects traffic total to increase. Skeds are kept with W7LP, W6CZM, VE5CD and WFAT. VE5AL keeps a solitary sked and has a fair traffic total. VE9AJ's station is slowly progressing and is expected to be on the air in the near future.

Traffic: VE5GO 37, VE5AL 26, VE5BR 9.

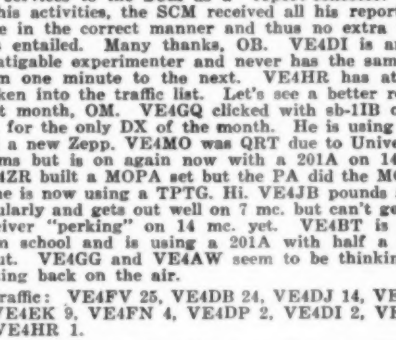
PRAIRIE DIVISION

MANITOBA—SCM, D. B. Sinclair, VE4FV—Poor weather has done little to dampen the enthusiasm of the gang this month. Despite the worst conditions we have experienced this year the traffic total has gone up. FB, boys! VE4FV tops the list although too busy with University exams to pound much brass. His only DX was a report from Russia but he is now on 28 mc. and expects WAC pronto. VE4DB puts out one of the best signals in town and is grimly determined to work "another" DX station before Jan. 1st. VE4DJ is on very consistently and gets out well, his only grief being key-clicks. The U. exams put a damper on VE4DK's activity and he was not on as much as usual. He claims his 210 is going soft. VE4EK has been working late and has been on very little. He plans to rebuild his junk for new conditions. VE4FN has a nice 7790 kc. Zepp but the only place it will work is on 7315 kc. Hi. VE4DP has offered his services to the SCM as a "report-collector." Due to his activities, the SCM received all his reports on time in the correct manner and thus no extra work was entailed. Many thanks, OB. VE4DI is an indefatigable experimenter and never has the same set from one minute to the next. VE4HR has at last broken into the traffic list. Let's see a better report next month, OM. VE4GQ clicked with sb-1IB on 14 mc. for the only DX of the month. He is using a 50 and a new Zepp. VE4MO was QRT due to University exams but is on again now with a 201A on 14 mc. VE4ZR built a MOPA set but the PA did the MOing, so he is now using a TPTG. Hi. VE4JB pounds away regularly and gets out well on 7 mc. but can't get his receiver "perking" on 14 mc. yet. VE4BT is back from school and is using a 201A with half a watt input. VE4GG and VE4AW seem to be thinking of getting back on the air.

Traffic: VE4FV 25, VE4DB 24, VE4DJ 14, VE4DK 9, VE4EK 9, VE4FN 4, VE4DP 2, VE4DI 2, VE4GQ 1, VE4HR 1.

SASKATCHEWAN—SCM, W. J. Pickering, VE4FC—VE4GR is on regularly but reports that there is very little activity and no traffic during the noon hour now. VE4IH is wondering where the Manitoba gang are as all his messages for that province have to be mailed. VE4FC is still rebuilding but it won't be long now.

Traffic: VE4IH 18, VE4GR 10.



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WITH the insistent demand for quality reproduction, power amplification has become a vital radio necessity Today, it is hard to find a radio set manufacturer who does not employ one or more power tubes in the output stage of his receiver.

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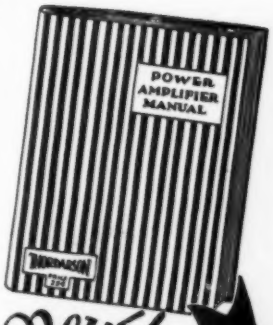
Thordarson Power Amplifiers are exceedingly easy to assemble, even for the man with no previous radio experience Only the simplest tools are used Specific instructions with clear-cut photographs, layouts and diagrams insure success in home construction

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QST

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be spared. The set seems to function quite satisfactorily with grid leaks.

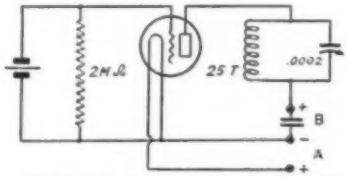
One TB-04/10 Phillips valve is used as the oscillator, and two for the amplifier (only one being shown in the diagram, since the tubes are operated in parallel). These tubes are rated at 10 watts output.

Power supply is secured from a very fine 480-volt storage battery donated by the Tudor Accumulator works.

The antenna is a third harmonic Marconi, and like the antenna used by Mr. Schnell on the "Seattle" some years ago, was erected in the "least worst" position. A good ground was secured from the steel hull of the ship itself.

The original receiver was a Schnell with one audio, but signals were so unsteady—due to the proximity of other wires—that an aperiodic coupling tube was added, as shown. Signals are not stronger with this, but are steadier.

Our pride in this set is the switch-over system. A single throw accomplishes the following: Changes antenna from transmitter to receiver, turns off the transmitter



CRYSTAL RESONATOR CIRCUIT

filaments gradually, and brings on the receiver filaments gradually, cuts off the key, and switches the negative B battery from the transmitter to the receiver.

We believe that "L'Avenir" is the first vessel of her type equipped with a real amateur short-wave transmitter and operated by a ham. She is now on an extended cruise to Martinique, from where she will go to Tampa, Florida, where it is hoped that many American hams will visit her. A splendid welcome will be given anyone coming on board.

The call XEB4WK is used, the note being d. c. on a wavelength of 32 meters. All reports and cards may be sent to the Reseau Belge, 11 Rue du Congres, Brussels, Belgium.

INTERNATIONAL PREFIXES

Slowly, various governments are specifying the amateur prefixes to be used under the requirements of the 1927 Radio Conference of Washington Again, we wish to urge upon amateurs everywhere that they advise us immediately upon receipt of authentic information as to the prefix to be used for their countries. Prefixes have already been designated for some nine countries, as follows:

Australia	MH
Canada	VE
Cuba	CM

The phantoms of music now become REALITY!



INSTRUMENTS—golden notes—formerly lost to radio now come through broadcast receivers in full tonal beauty. No longer does the bass viol come in thinly on overtones alone—no more do the shrill notes of the piccolo at top register die away in a shrill, reedy absurdity. The modern radio has TONE!

Better broadcasting—b e t t e r tubes—better speakers—but it has remained for Sangamo to build transformers to match these improvements. And particular attention is called to Sangamo Push-pull transformers! The Sangamo Push-pull Input Transformer has an extremely high primary inductance to secure faithful amplification of low notes and an accurately divided secondary insures practically identical frequency characteristics. There are Sangamo Push-pull Output Transformers to match the impedance of the various type power tubes and special Output Transformers for dynamic speakers.

In the Sangamo line there are transformers which permit set builders and manufacturers to produce the real tone fidelity. Are you ready for us to send you the data?

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Molded in Bakelite—unchanging value under all conditions of service.

Tone!

"X" Line Transformers

Type AX straight audio amplification, list price $6.00
Type BX Push-pull Input unit, list price $6.50
Type CX-171 Push-pull Output transformer, for 171 or 250 power output tubes for cone speaker, list price $6.50
Type DX, same as CX except for 210 and 112 power tubes, list price $6.50
Type HX Push-pull Output for 171 or 250 Power output tubes to match the impedance of moving coil of Dynamic loud speaker, list price $6.50
Type GX, same as HX except for 210 and 112 power tubes, list price ....$.650
Type E output choke to match impedance of the various type power tubes, list $5.00

"A" Line Transformers

(Similar to "X" line but with special core metal to give slightly better curve)

Type A straight audio amplification, list price $10.00
Type B Push-pull Input transformer for all tubes, list price $12.00
Type C-171 Push-pull Output, for 171 or 250 type power tubes with cone speaker $12.00
Type 4-210, same as C except for 210 and 112 power tubes $12.00
Type H-171, Push-pull Output for 171 or 250 power tubes for Dynamic speaker $12.00
Type G-210, same as type H except for 210 and 112 tubes, list price $12.00
Type F Plate Impedance for use as a choke to prevent oscillation and for impedance coupled amplifiers, list, $5.00



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Maximum Inverse Voltage .....70000 v
Voltage Drop (approximate) .....15 v
Maximum Peak Current .....1 ampere

An Oxide coated Cathode is heated by an internal, coil filament; this filament takes 10 volts and draws only 1.7 amps.

The plate connection is at the top and a UX base at the bottom and fuses furnished with each tube.

These tubes are IDEAL for the power amplifier sets.

Price $10 each. Postpaid in U.S. if cash accompanies order: avoid delay in the receipt of your PAIR by placing your order NOW.

We are now repairing the following tubes: 203a (Thoriated) $19 204A (Thoriated) $75; WE211 (Oxide) $16.50 and prepared to give immediate service on these type tubes.

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Mexico	X
New Zealand	ZL
Portugal	CT
Salvador	YS
United States (territorial)	W
" " (possessions)	K

Make a list of these new prefixes and put it somewhere in sight on the operating table. You will be hearing them from now on. Additions will be listed in this department as fast as they become known.

Belgian Section Report

By W. Keeman, Traffic Mgr., R. B.

DX conditions both on 20 and 40 meters have been very bad lately, with but a few exceptions. During the latter part of November not a single W was heard on 40 meters for weeks! Some EU's and A's (especially AG's) were reported with good strength. After a series of tremendous gales which swept over Europe recently, these contacts got slightly better. On the whole, however, latter November was a very bad month for that part of the human race known as Dutch hams. On 10 meters WIN and BU have heard a few W stations; W2JN was heard on October 28 QRK R3-4 with bad QSS.

At last it appears that we will get our long-desired licenses, only the 160-meter band remaining closed to us. Full details are not yet available, but will be published as soon as the regulations are issued.

We are now endeavoring to transfer all local phones to the 80-meter band, in order to reserve 20 and 40 for dx work. We hope that other countries will follow this example.

If any foreign station wants the cooperation of Dutch hams for tests, we will always be pleased to publish his skeds in our weekly organ. Please write to the Traffic Department of the N.V.I.R., c/o Mr. A. H. L. Fortuin, Vlamingstraat 37, The Hague, Holland.

Denmark Section Reports

By Helmer Peterfen, OZ_7SP

We have the pleasure of informing our foreign friends that the new regulations for this country have at last appeared from our General Directory for Post and Telegraph Service. The regulations, based of course on the regulations carried by the Washington Convention of 1927, are as follows:

Frequency Bands

Kilocycles	Meters
1730	173.4
1830	163.9
1930	155.4
3830—3990	78.3—75.2
7010—7290	42.8—41.15
14020—14380	21.4—20.86
28030—29970	10.7—10.01
56100—59900	5.34—5.01

Amateur Band "De Luxe" Receiver!

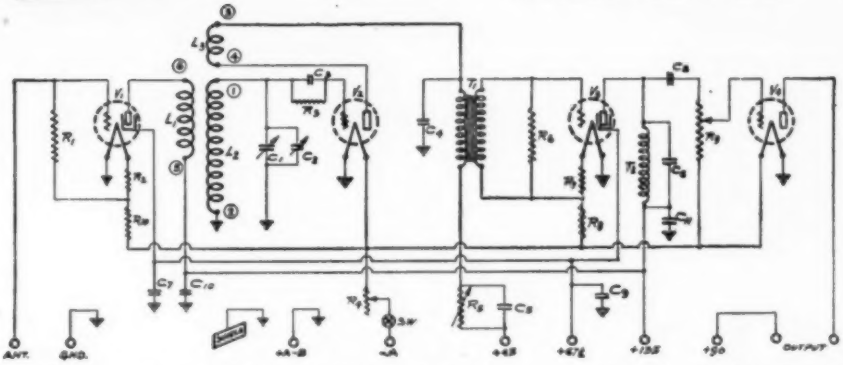
REL



Screened Grid R. F. — Detector — Tuned Peak Audio—Combined with full spread tuning for each new 1929 Amateur Band. A truly Great Receiver which every Ham will want to own. See Nov. *QST*, page 9.

The Radio Engineering Laboratories Cat. No. 217 Amateur Band De Luxe Receiver may be purchased as a complete kit or else any of the parts used in the receiver may be secured individually. The wiring diagram below gives full explanation on the circuit and the material necessary. The illustration on the left shows this receiver mounted in a metal case. The complete kit of parts includes the metal case and the neatly engraved aluminum front panel, the dimensions of which are 9" x 19" front x 10" deep.

The kit price on the REL Cat. No. 217 Receiver is $58.00. If you so desire, REL can supply this receiver completely built and tested at a slight additional cost.



L1,L2,L3—One complete set REL Cat. No. 182 coil kit (This contains three coils and the base) designed to cover 3500 to 7000 and the 14,000 KC bands.
C1,C2—One REL Cat. No. 187E secondary tank variable condenser with special movable vernier for obtaining full scale spreading for each band.
C3—.0001 mfd. Fixed condenser
C4—.002 mfd. fixed condenser
C5—.5 mfd fixed condenser
C6—.01 mfd. fixed condenser
C7—.1mfd. fixed condenser
C8—.006 mfd. fixed condenser
C9—.1 mfd. fixed condenser
R1—10,000 ohm metallized grid leak
R2,R7—10 ohm strip resistances
R3—10 meg ohm grid leak
R8,R10—5 ohm strip resistances
R4—10 ohm rheostat
R5—50,000 ohm variable resistance
R6—.1 meg ohm grid leak
R9—500,000 ohm variable potentiometer
T1—5 to 1 ratio audio transformer
T2—One REL Cat. No. 217 tuned audio choke—$9.00
V1,V3—UX-222 tubes
V2,V4—UX-201A or 112A tubes

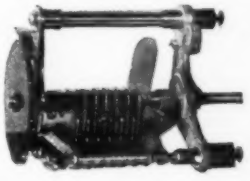


AMATEUR Band Coil Kit—Three plug-in coils and one base constitute the necessary inductances for tuning the three popular amateur channels, that is, the 20, 40 and 80 meter bands. The coils have been designed to operate in conjunction with REL Cat. No. 187E combined tank and vernier type condensers. Any similar type of condenser may be employed, the tank capacity of which should be 115 mmfds. maximum, and the vernier capacity should be approximately 20 mmfds. maximum.

The successful spreading out of each of the new 1929 narrow bands can only be accomplished by using these coils in conjunction with the REL condenser mentioned. This coil kit is adaptable to various other popular short wave circuits.

Cat. No. 182 Amateur Band Coil Kit. Price $10.00

COMBINED Tank and Vernier Condenser—A condenser of this type is absolutely essential in all receivers which are designed to give full spread tuning of each of the new 1929 bands. Imagine the enormous benefits derived by having these small channels spread out over the full scale of the condenser dial. You, no doubt, have already realized that an instrument such as this is an absolute necessity. These condensers being of exceptional rugged construction will be found very desirable for high frequency receiver work.



The large semi-variable capacity is rotated by means of the bakelite disc. This disc may be notched so that the locking device supplied will fit these notches. In this manner, it will be easy to always return the large capacity to a setting previously employed. The small vernier condenser is then used to obtain full spread tuning. Adjustment of the vernier condenser is made from the front whereas the adjustment of the large tank condenser is made at the rear. This need only be set when the plug-in coils are interchanged when shifting from one band to another. **Cat. No. 187E condenser..... Price $6.25**

Have you received your REL 1929 booklet? It's ready now. When you rebuild, be sure to do it the REL way.

RADIO ENGINEERING LABS., 100 Wilbur Ave., L. I. City, New York, U.S.A.

Fixed and Adjustable Resistors

for all Radio Circuits

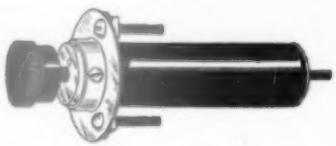


Bradleyunit-B

RADIO manufacturers, set builders and experimenters demand reliable resistors for grid leaks and plate coupling resistors. For such applications Bradleyunit-B has demonstrated its superiority under all tests, because:

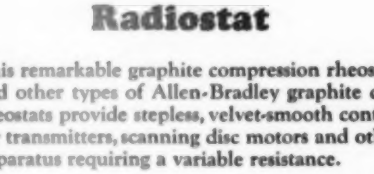
1—*Resistance values are constant irrespective of voltage drop across resistors. Distortion is thus avoided*
2—*Absolutely noiseless*
3—*No aging after long use*
4—*Adequate current capacity*
5—*Rugged, solid-molded construction*
6—*Easily soldered*

Use the Bradleyunit-B in your Radio Circuits



Radiostat

This remarkable graphite compression rheostat, and other types of Allen-Bradley graphite disc rheostats provide stepless, velvet-smooth control for transmitters, scanning disc motors and other apparatus requiring a variable resistance.



Laboratory Rheostat

Type E-2910 — for general laboratory service. Capacity 200 watts. Maximum current 40 amperes. A handy rheostat for any laboratory.

Write for Bulletins!

ALLEN-BRADLEY CO., 277 Greenfield Ave., Milwaukee, Wis.

Allen-Bradley Resistors

In previous issues of this magazine we have referred to the signals of XEB4WK, the Belgian training ship "L'Avenir." Through the courtesy of the Reseau Belge we are able to print the following extremely interesting photos and description of this all-amateur installation.

XEB4WK

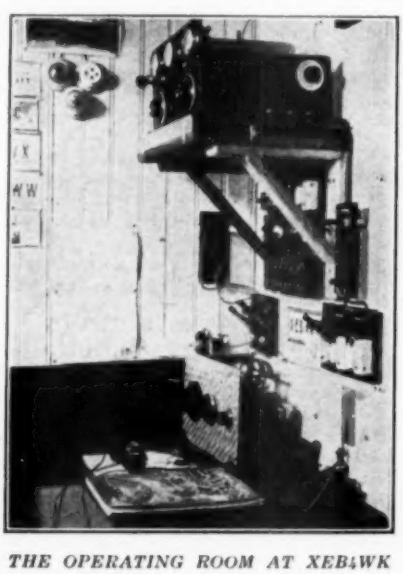
By EB4WW

L'AVENIR", or XEB4WK, is a large four-masted sailing training ship, one of the finest of her kind afloat. On each trip she carries, in addition to cargo, about 70 midshipmen who are learning how to become licensed marine officers for the mercantile shipping board in Belgium. It might be pointed out that there is no auxiliary power of any kind, sails alone being used for propulsion.

EB4FT and myself thought it would be interesting to put on board an experimental amateur set, and after obtaining the necessary permission we designed, and installed the transmitter and receiver shown in the photograph. The set was built by Mr. Velghe.

The first circuit tried out was a Mesny (push-pull) two-tube, but it resulted in too much QSSS with all that maze of wire stays and halyards only several feet from the antenna. It was almost impossible to read when the wind was blowing.

The cure was a M.O.P.A. circuit, which after some changes emerged as shown in



THE OPERATING ROOM AT XEB4WK

the circuit diagram. Best results were secured with a very small coupling capacity direct to the oscillator plate. The capacity used to balance the amplifier was quite critical in adjustment. Grid bias for the amplifier would have been very useful, but since the set is battery operated, could not



Reap Big Dividends from this Investment in Tone Quality

A Thordarson Power Amplifier (Home Constructed) Will Transform Your Radio Into a Real Musical Instrument

WITH the insistent demand for quality reproduction, power amplification has become a vital radio necessity Today, it is hard to find a radio set manufacturer who does not employ one or more power tubes in the output stage of his receiver.

There is no need, however, for you to discard your present radio instrument in spite of the fact that it is outclassed by newer models with power amplification. You can build a Thordarson Power Amplifier which, attached to your receiver, will provide a fullness and richness of reproduction that will equal or surpass the finest offerings of the present season.

Thordarson Power Amplifiers are exceedingly easy to assemble, even for the man with no previous radio experience Only the simplest tools are used Specific instructions with clear-cut photographs, layouts and diagrams insure success in home construction

Whether your present receiver is factory made or custom built one of these amplifiers may be attached with equal ease. In fact, most Thordarson Amplifiers require absolutely no changes in the wiring of the receiver itself, attachment being made by means of a special plug which fits the last audio socket of the receiver.

Thordarson Power Amplifiers for the home constructor and professional set builder range from the simple plate supply unit up to the heavy-duty three stage units employing the 250 type power tube in push-pull arrangement These power amplifiers cover the requirements for every purpose and every pocket-book. They may be used with any type of horn, cone or dynamic speaker.

With a background of over thirty-three years manufacturing quality transformers, it is only natural that so many manufacturers of receiving sets of undisputed superiority have turned to Thordarson as the logical source of their audio and power supply transformers The discriminating home constructor will do well to follow the lead of these manufacturers when buying his power amplifier

Write to the factory today, enclosing 25c for the new "Power Amplifier Manual"—just off the press



New!

No Amateur or Professional Set Builder Should Be Without This Book—

"POWER AMPLIFIER MANUAL"

A simple, yet complete, treatise on the subject of audio and power amplification, including full information on building, servicing, and testing power amplifiers in general. Also contains detailed specific construction data on twelve individual power units, with clear-cut layouts and diagrams of each.

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500 West Huron Street, Chicago, Illinois

Gentlemen: Please send me your new "Power Amplifier Manual" for which I am enclosing 25c. ☐

Please send me free of charge your instruction sheet on the amplifier I have checked below:

171 Single ☐. 171 Push-Pull ☐. 210 Single ☐. 210 Push-Pull (1 Stage) ☐. 210 Push-Pull (2 Stage) ☐. 250 Single (1 Stage) ☐. 250 Single (2 Stage) ☐. 250 Push-Pull (2 Stage) ☐. 210 Phonograph Amplifier ☐.

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QST 7

THORDARSON
RADIO TRANSFORMERS

SUPREME IN MUSICAL PERFORMANCE

Are We Right?

You should have at least two of them — one for your complete 1928 file of copies, and one for each 1929 issue as published.

Keep them as a unit in a

QST Binder



Note the wire fasteners. Unnecessary to mutilate copies. Opens and lies flat in any position.

One-fifty each

postpaid

A binder will keep your QSTs always together and protect them for future use. And it's a good-looking binder, too.

Q S T

1711 Park St., Hartford, Conn.

be spared. The set seems to function quite satisfactorily with grid leaks.

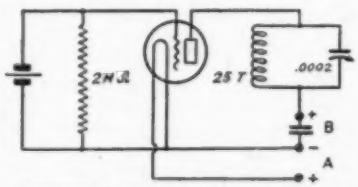
One TB-04/10 Phillips valve is used as the oscillator, and two for the amplifier (only one being shown in the diagram, since the tubes are operated in parallel). These tubes are rated at 10 watts output.

Power supply is secured from a very fine 480-volt storage battery donated by the Tudor Accumulator works.

The antenna is a third harmonic Marconi, and like the antenna used by Mr. Schnell on the "Seattle" some years ago, was erected in the "least worst" position. A good ground was secured from the steel hull of the ship itself.

The original receiver was a Schnell with one audio, but signals were so unsteady—due to the proximity of other wires—that an aperiodic coupling tube was added, as shown. Signals are not stronger with this, but are steadier.

Our pride in this set is the switch-over system. A single throw accomplishes the following: Changes antenna from transmitter to receiver, turns off the transmitter



CRYSTAL RESONATOR CIRCUIT

filaments gradually, and brings on the receiver filaments gradually, cuts off the key, and switches the negative B battery from the transmitter to the receiver.

We believe that "L'Avenir" is the first vessel of her type equipped with a real amateur short-wave transmitter and operated by a ham. She is now on an extended cruise to Martinique, from where she will go to Tampa, Florida, where it is hoped that many American hams will visit her. A splendid welcome will be given anyone coming on board.

The call XEB4WK is used, the note being d. c. on a wavelength of 32 meters. All reports and cards may be sent to the Reseau Belge, 11 Rue du Congres, Brussels, Belgium.

INTERNATIONAL PREFIXES

Slowly, various governments are specifying the amateur prefixes to be used under the requirements of the 1927 Radio Conference of Washington Again, we wish to urge upon amateurs everywhere that they advise us immediately upon receipt of authentic information as to the prefix to be used for their countries. Prefixes have already been designated for some nine countries, as follows:

Australia	MH
Canada	VE
Cuba	CM

The phantoms of music now become REALITY!



INSTRUMENTS—golden notes—formerly lost to radio now come through broadcast receivers in full tonal beauty. No longer does the bass viol come in thinly on overtones alone—no more do the shrill notes of the piccolo at top register die away in a shrill, reedy absurdity. The modern radio has TONE!

Better broadcasting—b e t t e r tubes—better speakers—but it has remained for Sangamo to build transformers to match these improvements. And particular attention is called to Sangamo Push-pull transformers! The Sangamo Push-pull Input Transformer has an extremely high primary inductance to secure faithful amplification of low notes and an accurately divided secondary insures practically identical frequency characteristics. There are Sangamo Push-pull Output Transformers to match the impedance of the various type power tubes and special Output Transformers for dynamic speakers.

In the Sangamo line there are transformers which permit set builders and manufacturers to produce the real tone fidelity. Are you ready for us to send you the data?

Sangamo Condensers

Molded in Bakelite—unchanging value under all conditions of service.

Tone!

"X" Line Transformers

Type AX straight audio amplification, list price $6.00
Type BX Push-pull Input unit, list price $6.50
Type CX-171 Push-pull Output transformer, for 171 or 250 power output tubes for cone speaker, list price $6.50
Type DX, same as CX except for 210 and 112 power tubes, list price $6.50
Type HX Push-pull Output for 171 or 250 Power output tubes to match the impedance of moving coil of Dynamic loud speaker, list price $6.50
Type GX, same as HX except for 210 and 112 power tubes, list price ....$.650
Type E output choke to match impedance of the various type power tubes, list $5.00

"A" Line Transformers

(Similar to "X" line but with special core metal to give slightly better curve)

Type A straight audio amplification, list price $10.00
Type B Push-pull Input transformer for all tubes, list price $12.00
Type C-171 Push-pull Output, for 171 or 250 type power tubes with cone speaker $12.00
Type 4-210, same as C except for 210 and 112 power tubes $12.00
Type H-171, Push-pull Output for 171 or 250 power tubes for Dynamic speaker $12.00
Type G-210, same as type H except for 210 and 112 tubes, list price $12.00
Type F Plate Impedance for use as a choke to prevent oscillation and for impedance coupled amplifiers, list. $5.00



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Maximum Inverse Voltage .....70000 v
Voltage Drop (approximate) .....15 v
Maximum Peak Current .....1 ampere

An Oxide coated Cathode is heated by an internal, coil filament; this filament takes 10 volts and draws only 1.7 amps.

The plate connection is at the top and a UX base at the bottom and fuses furnished with each tube.

These tubes are IDEAL for the power amplifier sets.

Price $10 each. Postpaid in U.S. if cash accompanies order: avoid delay in the receipt of your PAIR by placing your order NOW.

We are now repairing the following tubes: 203a (Thoriated) $19 204A (Thoriated) $75; WE211 (Oxide) $16.50 and prepared to give immediate service on these type tubes.

Midwest Representatives

CHIRAD and HENRY RADIO SHOP

NATIONAL RADIO TUBE CO.,
3420 18th St., San Francisco, Cal.

Denmark	OZ
Mexico	X
New Zealand	ZL
Portugal	CT
Salvador	YS
United States (territorial)	W
" " (possessions)	K

Make a list of these new prefixes and put it somewhere in sight on the operating table. You will be hearing them from now on. Additions will be listed in this department as fast as they become known.

Belgian Section Report

By W. Keeman, Traffic Mgr., R. B.

DX conditions both on 20 and 40 meters have been very bad lately, with but a few exceptions. During the latter part of November not a single W was heard on 40 meters for weeks! Some EU's and A's (especially AG's) were reported with good strength. After a series of tremendous gales which swept over Europe recently, these contacts got slightly better. On the whole, however, latter November was a very bad month for that part of the human race known as Dutch hams. On 10 meters WIN and BU have heard a few W stations; W2JN was heard on October 28 QRK R3-4 with bad QSS.

At last it appears that we will get our long-desired licenses, only the 160-meter band remaining closed to us. Full details are not yet available, but will be published as soon as the regulations are issued.

We are now endeavoring to transfer all local phones to the 80-meter band, in order to reserve 20 and 40 for dx work. We hope that other countries will follow this example.

If any foreign station wants the cooperation of Dutch hams for tests, we will always be pleased to publish his skeds in our weekly organ. Please write to the Traffic Department of the N.V.I.R., c/o Mr. A. H. L. Fortuin, Vlamingstraat 37, The Hague, Holland.

Denmark Section Reports

By Helmer Peterfen, OZ7SP

We have the pleasure of informing our foreign friends that the new regulations for this country have at last appeared from our General Directory for Post and Telegraph Service. The regulations, based of course on the regulations carried by the Washington Convention of 1927, are as follows:

Frequency Bands

Kilocycles	Meters
1730	173.4
1830	163.9
1930	155.4
3830—3990	78.3—75.2
7010—7290	42.8—41.15
14020—14380	21.4—20.86
28030—29970	10.7—10.01
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Amateur Band "De Luxe" Receiver!

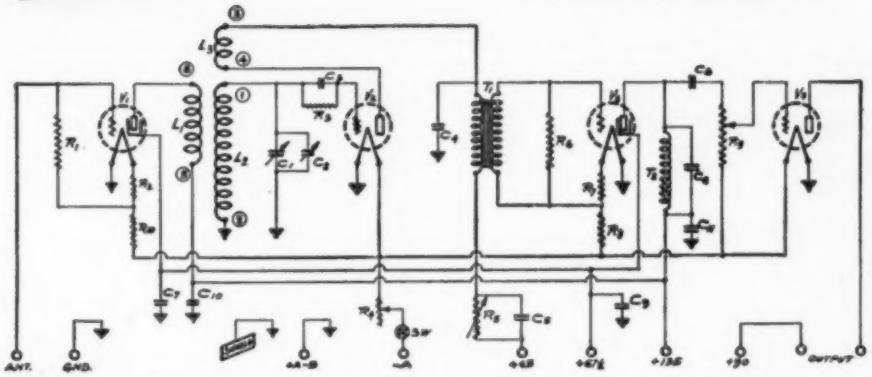
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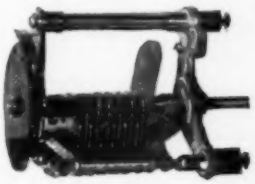


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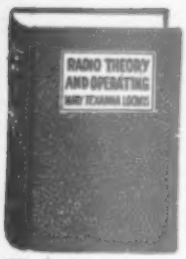
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RADIO ENGINEERING LABS., 100 Wilbur Ave., L. I. City, New York, U.S.A.



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MONEY SAVERS

Thordarson 150 Watt Power Transformer rated at 800 volts, 11 volts center tapped and 4 volts no center **$5.95**

Thordarson 60 Henry Double Chokes, 30 henrys each choke, 150 M. A. **$4.95**

Thomas Andrews 20 mfd. Condenser Block, tapped at 4, 6, 5, 2, 2, 1, .1 and .1, mfd. 400 volts working voltage . . **$3.95**

Erla 1,000 cycle peaked audio transformers . . . . . **$ .95**

The above transformer, choke and condenser combination will make an ideal power supply for a crystal oscillator.

The full 800 volts can be utilized by disregarding the center tap and connecting the two outside terminals to a bridge chemical rectifier or thermionic half wave rectifier.

The condensers can be connected in series giving 800 volt working voltage. 1,000 cycle audios are a necessity in these days of heavy qrm.

The peak can be tuned by a variable .0005 mfd. condenser shunted across the secondary.

RADIO EQUIPMENT CO.
W9DFW
549 S. WELLS ST. CHICAGO, ILL.

The waves sent out must be as free from harmonics and as constant in frequency as the state of the art permits. Use of raw or insufficient rectified AC for plate supply and keying by spacing wave is prohibited.

Calls, in the future, will consist of the prefix OZ followed by one figure and not more than three letters. Present calls may be kept unaltered, except that the intermediate ED is replaced by the prefix OZ. If a shorter call is wanted, it may be changed upon application for a call consisting only of OZ, one figure, and *one letter*, as for instance, OZ2C. Applications for short calls had to be in the hands of tthe G.P.T.S. before December 20, 1928.

All general regulations carried by the International Radio Convention must be maintained.

Conditions in Denmark are not so good at present. Only Spain, Italy and the U.S. S.R., with now and then a single British station, are heard. 0000 to 0100 GMT (7P.M. to 8 P.M. E.S.T.—Ed.) seems to be the best hour for WQSO's.

To help Danish hams prepare for the 1929 conditions, E.D.R. (the national amateur society) has taken up the work of calibrating wave-meters. Further, as a good many Danish transmitters are going to have their sets crystal-controlled, the E.D.R. is making arrangements to supply the hams with crystals at moderate prices.

The Danish expedition ship "Dana" is now in the Pacific Ocean, and has on board the short-wave station OXQ, operating on 37 and 23 meters. QSO's will be welcomed, and reports are solicited.

The year 1929 is here; we wish all our foreign friends a happy new year.

German Section Reports

By E. Reiffen, Sec'y, D. A. S. D.

The DX-crowd says that conditions have not bettered materially in the last month. Distance QSO's on 40 and 30 were good in part. On 20, as in the preceding months, the conditions were very changeable.

According to the new German regulations, no German ham may send with a.c. after January first, 1929. It would be desirable if all countries were to set up such a prohibition.

The German short-wave transmitters are very much hindered by the long hours of transmission indulged in by the broadcasters. A favorable solution of this has been found by a few DX-amateurs who during the day use a low-power transmitter of 5 watts or less, which cannot interfere with a B. C. receiver in the next room. Even with 5 watts many QSO's up to 3500 km. have been made.

For the most part, German amateurs are still unlicensed, but the license matter is finally in a developmental stage, and we count on a decision being made early in 1929.

The DX-transmitters have rebuilt their sets for 1929, and a few also are becoming



GOOD INSULATION *Promptly and Accurately!*

LEADING radio and electrical manufacturers have regarded Formica as their source of supply on insulating parts for many years.

Amateur receiver and transmitter builders have likewise found Formica to offer panels, tubes, rods and similar insulating parts that are always dependable, well finished and good-looking.

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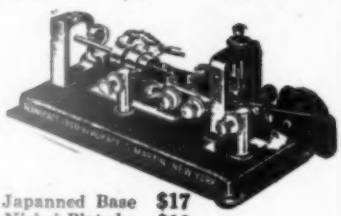


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interested in the 10-meter tests. The D.A.S.D. has offered two transmitting tubes as a prize for the first 10-meter QSO between Germany and America.

The year 1928 is now over. We wish all transmitting amateurs a Happy New Year, best DX on all bands and a good amateur spirit. 73 to all.

British Section Reports

By the Radio Society of Great Britain

Outstanding during the month has been the fine progress made on the 28,000-kc. band.

On October 21st Mr. J. W. Matthews, G6LL, established the first British contact with America, thus winning the new Wortley Talbot cup presented by Dr. Wortley Talbot, G6WT.

Later on the same day Mr. Scott, GW17C, and Mr. E. J. Simmonds, G2OD, established two-way communication with the States.

These performances were eclipsed on the following Sunday, October 28th, when Mr. Rodman, G2FN (late AI2KT) was in communication witth W6UF using only 8 watts input!

Since that time several British stations have been heard, or have communicated with the States, and all ears are now being turned to the 28,000 KC signals from Australia.

It is found that DX signals on this band are best between 1300 and 1900 GMT (8AM—2 PM, E.S.T.—Ed.) and amateurs in all European countries are asked to listen for British stations calling on this band.

The type of aerial favored by our pioneer men is a vertical antenna of the half-wave Zeppelin type.

Crystal control is used by most of our DX amateurs, whilst the low-power men are either using crystal control or MOPA. All British stations are required to have accurate means of checking their transmissions, and in this connection the crystal resonator is found to be of very great use. The circuit for this is shown in the accompanying figure. The crystal is connected between grid and filament and various coils and condensers used to tune the circuit to resonance. A milliameter in the high-voltage supply will be found useful. This should show a very small current when the crystal is oscillating. The crystal oscillates on its fundamental, and if the "resonator" is coupled to the receiver the harmonics can be picked out. The resonator can also be coupled to the heterodyne wavemeter and later checked before each transmission.

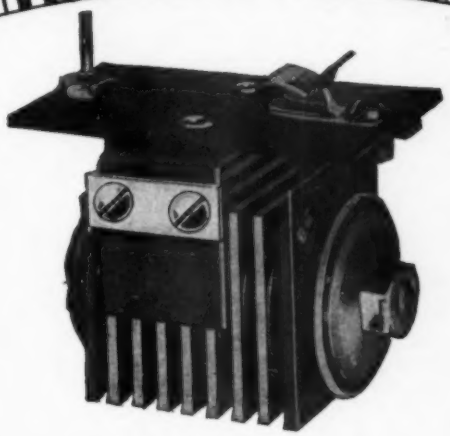
Several reliable British firms have commenced the manufacture of low-priced crystals, and we shall be pleased to put any amateur in touch with these companies.

No British stations are now working on 3500 KC. At a recent meeting of the R. S. G. B. it was decided to speak in terms of frequency, and not in wavelengths.

NOW! An Elkon Dry Rectifier for PHILCO POWER UNITS

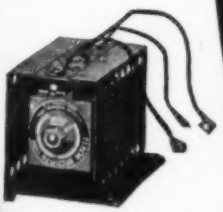


Type BNK for replacing the acid jars in Balkite Types N and K Trickle Chargers





5000 hour type EBH rectifier for replacing BH type tubes in "B" eliminators. Replaces fragile 1000 hr. tubes.



Type BJ for replacing the acid jars in Balkite Type J chargers

THIS new Elkon all-dry metallic rectifier Type U-P-8 is so designed that it replaces the wet jar rectifiers designated as Philcatron A and Philcatron AA used in Philco Trickle Chargers, Philco "A" Powers and Philco A and B combinations.

Very simple to attach, two wires to connect. May be done in a minute by anyone. No liquids to bother with—no attention—just satisfaction.

Do not be surprised at its small size—for in its sturdy couples are packed thousands of hours of perfect service. Its compactness is one of the reasons for its efficiency. The U-P-8 is a fitting member of the Elkon family of dry-metallic rectifiers. Visit your dealer today.

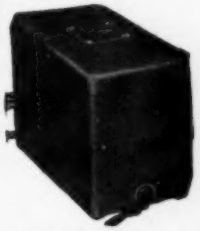
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Samson Electric Co.	Fansteel Products Co.
Philadelphia Storage Battery Co.	Zenith Radio Corp.
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Calls Heard

(Continued from Page 53)

eh-9xf eh-9xg ei-1xo ei-1xy ei-1dr ei-1fe ei-1op ei-1cmm ei-1mm ei-1dc ei-1po ei-1as ei-1ss ei-1xy ei-1mx ej-7dd ej-7ff ej-7oo ej-7ww ek-4vt ek-4af ek-5kg ek-4dk ek-4yae ek-4uak ek-4cy ek-4hf ek-4abr ek-4abg ek-4adi ek-4xy ek-4ia el-1ala el-1alg el-1a2b em-smux em-smuk em-smxr em-smxs em-smxh em-smus em-smxn sm-smue sm-smxy sm-smuq en-pflx en-oga en-odj en-owim en-oax en-ocx en-ozf en-oqf en-ohi en-oopa en-owgx eo-18b ep-1bv ep-1br ep-1bs ep-1aa ep-1ae eq-4a eq-2aa er-5rr er-5af er-5ll er-5ll es-1eo es-2nm es-2dk es-5nl es-3de es-6dmt es-2nd es-1uw es-2nai es-7dj es-2nap es-3da et-tpkv et-tpkw et-tpew et-tpzz et-tplm et-tpar et-tpp3 et-tpsa et-tpam et-tpju et-1e et-2as et-3cx et-3pp et-3xy et-3va eu-1sp eu-2xq eu-2dq eu-2bkh eu-2cm eu-2ed eu-2crb eu-2as eu-2bw eu-3kac eu-3am eu-4ah eu-5ay eu-5bc eu-5ar eu-5al eu-6am eu-7kad eu-8aa eu-9ad eu-9kab eu-9am eu-9ac ex-1zf ex-1ww ex-1as zeg-sdm xev-rdq ai-2bj ai-2bl aq-2gq au-8aa ag-7kad fc-2dd fi-1ta fm-8kr fm-8ax fm-8rit fm-8kf fo-9wa fz-8xzl wlax w4rr w3ajh w3anq sa-3de sb-1ah sb-1ic sb-1ar sb-1bs su-8an z12cb.

C. Conte, 24, Allie du Rocher, Clichy sous Bois, Seine et Oise, France

wlabd wlacu wlafl wlage wlahv wlajx wlakm wlara wlawd wlaxq wlbcg wlbhs wlbke wlbl wlbif wlbux wlcjh wlckp wlcmf wlcmx wlcnz wldi wlgh wlgw wlic wlii wlmo wlmv wlom wlrf wlsi wlsk wlxf w2adb w2aeb w2afv w2agb w2alu w2anh w2apq w2aqk w2ase w2ass w2atq w2aub w2avk w2avw w2az w2azk w2baz w2bbc w2bck w2bdh w2bif w2box w2cc w2crb w2cuj w2cxl w2dh w2dl w2fs w2jc w2kx w2md w2rs w2sm w2tf w2tp w2ty w2wi w3acm w3afw w3ag w3ahl w3aib w3alp w3auv w3cx w3pf w3qe w3sz w3ut w4aau w4acd w4acv w4acz w4hx w4jr w4nf w4nh w4ob w4qz w4tu w4ux w5rg w5yb w6mu w8abw w8aly w8axx w8bjb w8box w8bto w8ccs w8ccw w8cke w8cnh w8cns w8ent w8exd w8dgl w8dke w8dme w8dne w8dod w8dps w8dsa w8es w8ex w8jq w8sh w8vb w9abu w9acs w9aid w9apy w9ara w9ayl w9che w9crd w9cy w9ces w9dsq w9ef w9efz w9uz velad velbo be2bg sa-de3 sa-dq4 sb-1ah sb-1ak sb-1bg sb-1bl sb-1br sb-1bs sb-1ca sb-1ck sb-1dc sb-2ag sb-2az sb-5bf sb-6qa sb-7aa su-2ak.

W3LB, Roger W. Clipp, Hagerstown, Maryland

wlafb wlahr wlbgq wlbld wlhj wlja w2blq w2chk w2gj w2pa w2rq w3acq w3alp w3anq w3ap w3auo w3awb w3blp w3b'z w3buj w3cv w3nj w3sn w3st w4ajk w4ll w4qf w4uc w4vt w5aee w5ib w5kh w5om w8akv w8arx w8bgp w8bhf w8bj w8bnr w8bpd w8bpr w8buz w8bvn w8bzn w8cfy w8chc w8cwo w8cxn w3czw w8dbn w8dpi w8rm w8xe w9ain w9amv w9bwl w9fdj.

W4AJY, Arthur F. Hill, 1504 Wilmer Ave., Anniston, Ala.

w6ac w6am w6qy w6uf w6abg w6akb w6adw w6apd w6atq w6ayc w6azy w6beu w6bhy w6bpm w6bqk w6bub w6bvs w6bzs w6cgq w6chl w6chv w6chy w6cih w6cjn w6cnn w6ctx w6csj w6cug w6cut w6cyx w6ddn w6dmg w6dnm w6dpa w6dpo w6dpu w6dvd w6dwn w6dwp w6dyo w6dyu w6eao w6eau w6ebn w6efc w6ehe w6ehi w6eii w7bd w8bo w7bx w7cx w7ey w7dd w7kf w7lp w7ts w7wl w8abh w7acj w7adj w7aeu w7ach w7ajx w7amx w7ant w7aoa fi-1ab k4aan nh-1ug nj-2pa nm-1g nm-9a nn-7nic nn-cab br-2ea nr-gc nq-2iq nq-2kp nq-5ay nq-5fl nq-5ry zl-2aw sc-1ag sc-1aw sc-1cj sc-1dr se-2ah sc-2ea ve3bm ve3cb ve3ca ve4fv ve4hh ve4gm ve5bk ve5cj.

W8CMB, Edward Nau, 2909 E. 37th St., Cleveland, Ohio.

(80 meters)

w5om w6bam w7aat w7iy.

(40 meters)

w6adg w6awy w6cha w6dca w6drb w6dyj w6uj hc-1dp hc-1em fn-3jn nn-1nic nn-7nic nq-2eo nq-5ay nq-5fl nr-2fg oa-2hm oa-3gr oa-5hg oa-7jl oz-2go sb-1aw sb-1ca sb-1ab sb-7ab se-1dr se-2ea ve4fv ys-1fm g6k g1ky mf8 fnjl oid oxva rwx scx ajb smla wfab wfat wsq wwet xaf xda xwab.

(20 meters)

w6asi w6csw w6cuh w6czr w6dog w6no w6ql et-2x cm-2jt ve4fv ve4dk ve4gm ve4hh sb-1cm.

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1. Before writing, consult the Radio Amateur's Handbook and your files of *QST*. Nine times out of ten the answer will be found.

2. Number the questions and make a separate paragraph of each one. Make the questions as brief as possible.

3. Write on one side of the paper only and use a typewriter if possible.

4. Make diagrams on separate sheets of paper and fasten them to your letter with a pin or paper clip.

5. *Print* your name and address in full on each sheet of paper. A return address on the envelope is not sufficient, as the envelope is destroyed by the office manager as soon as the letter is opened.

6. Keep an exact copy of your questions and diagrams and mention that you have done so.

7. Do not ask for opinions on, or comparisons of, business concerns or their products.

8. Enclose postage for the reply but do not send an envelope. It is more convenient for us to use our own en elopes with our stationary.

9. Address all questions to the Technical Information Service, American Radio Relay League, Inc., 1711 Park St., Hartford, Conn.



Precision power resistor. Speed control for small motors. Push-button accelerator. Sturdy iron case. Ample heat radiation. Protected terminals. Neat. Handy. Safe.

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Whether you are or are not interested in television, you have real use for this Speed Control Clarostat. It's a wow! Handy, compact, simple, practical. Handles 80 watts without flinching. An ideal line-voltage control. A fine heavy-duty resistor of any value from 25 to 500 ohms. And it only represents other members of the Clarostat family.

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Strays

Calories vs. Kilocycles

Dick Hilferty, formerly "DH" of W1FL now of the staff at WHD, and Miss Katherine Finnegan of Minneapolis and Grand Forks, North Dakota, were married in New York City on New Year's Day. As Mrs. Hilferty is a dietician of note, we know that the future "midnight meals" will be well worth participating in.

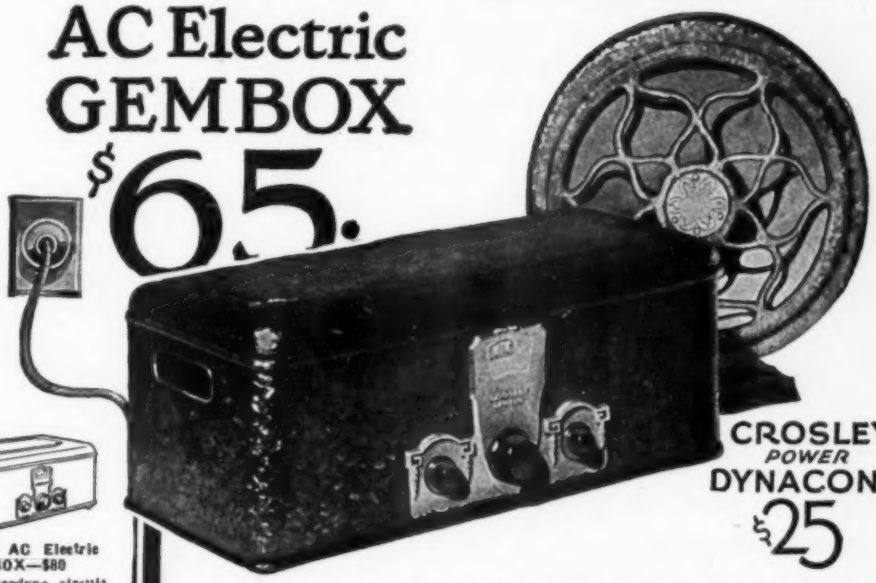
———

W5ATZ is enthusiastic about the idea of putting the receiver key and power switch within easy reach of his bed so that the station may be operated from the snoring position. For amateurs who have little time to operate during the day or early evening it permits sleep to be lost in favor of operating with a minimum of discomfort. On these cold nights, when the air is so full of interest, the scheme certainly results in more early morning international work than would be the case if it was necessary to get half dressed and sneak out to the shack.

———

The formula appearing on the chart on page 27 of the December issue contains the term "V²" which is not included in the tabulation. This should be "r²". It, of course, has no effect whatever upon the accuracy of the chart itself.

This CROSLEY AC Electric GEMBOX $65.



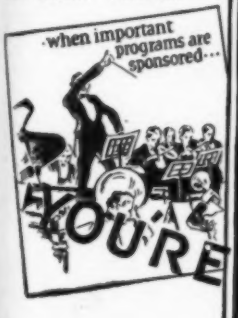
CROSLEY *POWER* DYNACONE $25

The 8 tube AC Electric SHOWBOX—$80

Genuine Neutrodyne circuit—push-pull audio amplification with two 171 power tubes on last stage—trouble proof Mershon condenser supplying full 180 volts CONSTANTLY — modern illuminated dial—(7 tubes, radio, detector, audio stages and 1 rectifier, 9 in all)—operating dynamic type power speaker—unbeatable in performance and value offered—$80.



Crosley Battery Type Sets embody superior advantages of new AC models. The 6 tube BANDBOX operates the DYNACONE, new Crosley dynamic type speaker. Price $55. The 5 tube BANDBOX Jr., is a dry cell set very easy on batteries and operates loud speaker. Price $35.



..gives no condenser trouble

The higher the voltage the better the reception. Crosley has designed this set to stand maximum power supplied CONTINUOUSLY. Celebrated Mershon Condensers used in the power supply section do NOT BREAK down. If they should be punctured they are self-nealing. Paper condensers constantly break down and the only safeguard is to reduce power which reduces enjoyment of your radio.

..operates power speaker

The popular dynamic quality of radio reception is attained in the new power CROSLEY DYNACONE. This speaker like its predecessor has created a tremendous demand because of its wonderful performance at so low a price. The range of true notes on this new speaker has been greatly increased over accepted standards.

..uses famous Neutrodyne circuit

This well known and preferred radio circuit is introduced into this inexpensive radio that you may possess the BEST possible apparatus for receiving radio programs. This with other Crosley features permits you a degree of selectivity and sensitivity that many a radio at twice and three times the $65 price of this set will never have.

..embodies latest radio improvements

Modern illuminated dial for dark corners—is easy to read especially these days of hunting about for station reallocations. The rich gold highlighted brown case is both an attractive container and an efficient shield. Everything about this amazing set is NEW, UP-TO-DATE! Enormous demand—mass production—straight line assembly—enables Crosley to top the radio world with this unmatchable value this season!

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POWEL CROSLEY, JR., Pres.

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Individual — Independent Speaker Volume Control



Constant Input Resistance
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The Centralab Constant Impedance Volume Control is the only unit that allows a number of speakers operated from the same amplifier to be controlled individually without affecting the other speakers in the circuit. It is a dual resistance unit with one resistance shunting the speaker for volume control and the other resistance in series with the line.

Adjusting the knob varies both resistances so that while one short circuits the speaker to control volume, the other resistance is added to the line maintaining a constant impedance. Easy to install, smooth and efficient in operation. Send for interesting booklet of picture and wiring diagrams, "Voltage and Volume Controls—Their Use."

Central Radio Laboratories
18 Keefe Avenue
Milwaukee, - - - - - Wisconsin



Strays

In the October IARU Department, on page 51, we ran a photograph of station ZL2AC, and stated that it was owned by Mr. Sydney Strong. The photo was indeed of ZL2AC, but the station is owned by Mr. Ivan O'Meara, and not by Mr. Strong. We regret that this error occurred.

Experimenters' Section

(Continued from Page 51)

bend so that in case of an accidental turning backwards of the scape wheel, the pin will lift it going in either direction and avoid damage. Adjust the gap to about 0.005 inch.

The pin should engage the V on the wiper at the beginning of the drop and it will

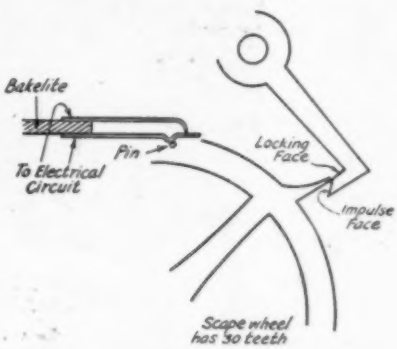


FIGURE 2

then hold contact while the tooth rides on the locking face of the pallet until the pendulum swings to the end of the arc and returns to the point where the tooth unlocks and enters the impulse face of the pallet. This will give a sustained period of about 1/3 second duration which will make a distinctive mark on the graph through some suitable wiring arrangement.

The current through the contacts should be of the order of two or three milliamperes and not more than 1.5 volts should be employed to avoid any welding effect at the contacts.

The reason for using two springs is that the oil on the pivots may sometimes act as an insulator to the weak current and, again, the electrolytic effect is not good for the oil.

Ten years ago, such a contact was put on a gauge here, operating through a sensitive relay to sound an alarm and it is still functioning.

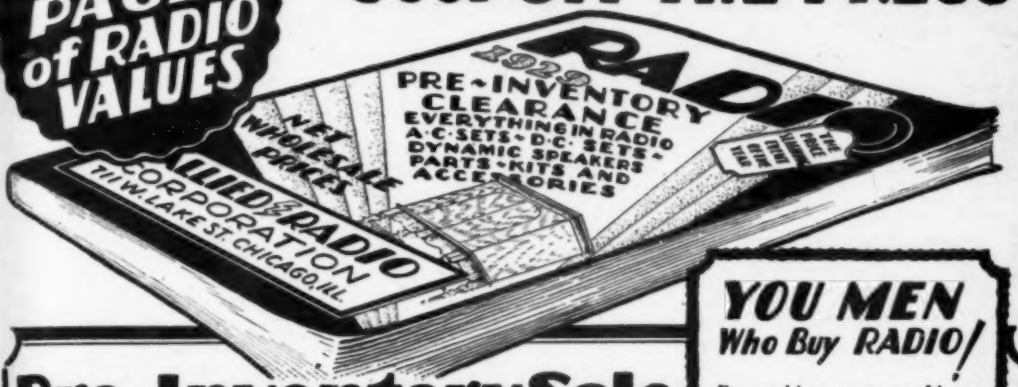
—George N. Engert.

COUPLING TO THE MONITOR

Our old friend Herb Walleze who is getting to be a regular contributor to the "X" Section suggests the method shown in Figure 3 by means of which the phones do

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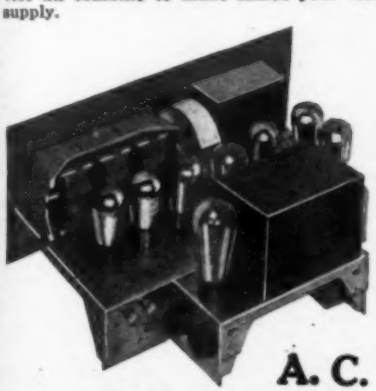
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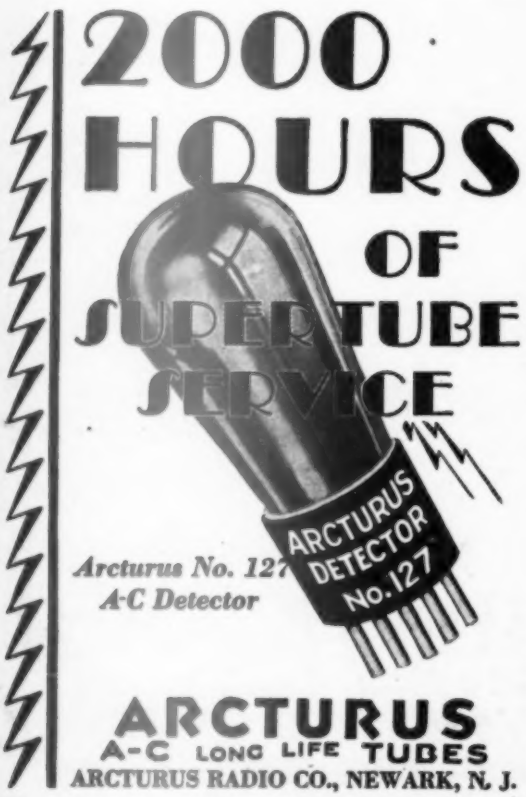
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QST

1711 Park St. Hartford, Ct.



not have to be continually switched from the monitor to the receiver and back again. By connecting the filament of the monitor tube across the six-volt starting relay, the monitor is automatically turned on with the tranmitter.

If a high ratio audio transformer is used, this arrangement will not reduce the strength of incoming signals. It does, however, reduce the strength of the signal from the monitor when compared with the method whereby the phones are transferred from

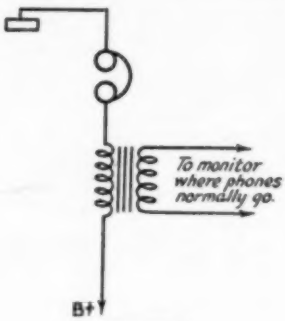


FIGURE 3

the receiver to the monitor although this reduction is not at all damaging. The time and trouble saved in switching over from one to the other more than compensate for any loss in monitor signal.

He also suggests that one of these E210 Bradleystats that may be obtained for about $1.60 makes a good field rheostat for the small motor-generator and costs about $15 less than the regular job built for the purpose.

REFLECTORS

Commenting upon the short note concerning reflectors, we received the following from W. G. Wagener, W6BEZ:

"A vertical half-wave antenna will radiate energy equally well in all directions and if a similar antenna is located parallel to it and a half wavelength from it, it will absorb some of this energy and re-radiate it. Because the second antenna is a half wavelength from the first, its induced current will be in phase with the current in the first antenna. This will result in best transmission of the combined energies of the antenna and reflector in a broadside direction as explained in previous articles on directional antennas.

"Consider the case of two wires close together. Let the current in the first one be increasing. The magnetic field will be building up about this wire and cutting, as it does so, the second wire. The induced current in the second wire must be in such a direction, that its magnetic field will oppose that field which is responsible for the induced current. This is the fundamental principle in the generation of any current. Obviously then the two magnetic fields will be 180° out of phase. If these two wires are so close together that the time for the magnetic field to travel from one to the



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List $6.00 Now only **$2.95**



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$5.50 Dubilier Cond. 2mfd; 600 v. D. C.	1.45
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Bristol 50 Henry choke	2.75

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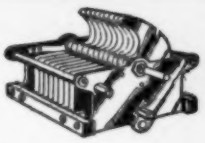
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General Radio 3 By Pass Condenser

$1. List. Tested at 500 v. D.C. Ideal for Filament By Pass



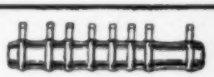
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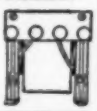
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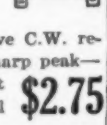
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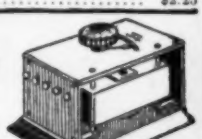
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other is negligible, the current induced must be 180° out of phase with the original.

"If these two wires are the two half-wave antennas and the first is carrying a rapidly alternating current and they are spaced such a distance apart that the time for the magnetic field to travel from one

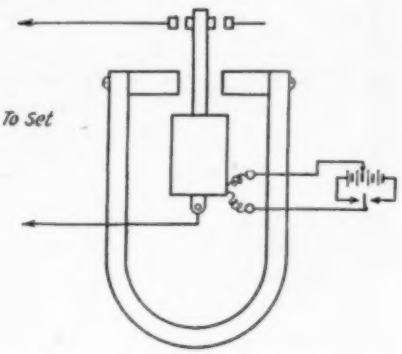


FIGURE 4

to the other, which it does with the speed of light, is the time required for one half a cycle, we have the original set-up of two antennas at a half wavelength apart. Hence the magnetic field which has arrived at the second antenna or reflector lags by half a cycle or 180° the magnetic field which is just leaving the first antenna. Adding this 180° lag to the 180° change when a current is induced in the reflector, we have 360° or one complete cycle which means that the currents in antenna and reflector are in phase.

"We see that whenever a magnetic field cuts a wire and induces a current in it, a change of phase of one half cycle or 180° must be allowed for.

"Consider now the reflector wire placed one quarter wavelength behind an antenna. For the magnetic field to travel from the antenna to the reflector requires one quarter cycle or 90°; for a current to be induced and re-radiate a magnetic field requires a half cycle or 180° change of phase and for this re-radiated field to return to the antenna requires an additional quarter cycle or 90°. Hence the total elapsed effective time is one whole cycle or 360°. Thus the two fields will be in phase and their energies will add to give increased radiation in the direction along a line from reflector to antenna. In the direction from antenna to reflector we found the two magnetic fields to be always 180° out of phase. This latter fact will be true no matter how far away from the antenna the reflector is placed, and so a resonant wire anywhere will always weaken the field behind it.

"From the preceding paragraph it is obvious that in a parabolic reflector, the distance from the antenna back to the nearest reflector wire must be a quarter wavelength. The parabola will then be built with this as the focal distance. Hence in

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†DeForest P or R. C. A. 852 Tube
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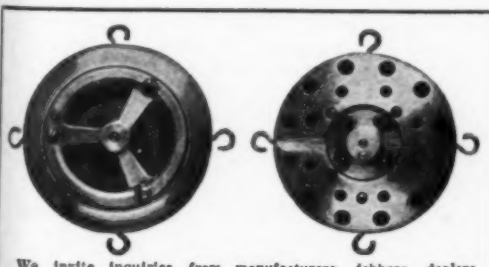
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(*See page one, January QST*)

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MALDEN, MASS.

Figure 5 on page 49 of the December issue, the distances should be $\lambda/4$ and $\lambda/2$.

"From the above considerations of phase changes in induced currents and the addition of wave motions of varying phase relations, any reflector system can be designed and analysed."

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Editor, *QST*:

Speaking of relays that will stay in either the make or break position without a continuous current flowing to hold the armature, a simple form of polarized relay can be made from parts available to all of us and at the same time fill the bill admirably.

A horseshoe magnet similar to those found on telephone magnetos is arranged as shown in Figure 4 with an electromagnet pivoted between the poles. The contact screws are set so as to just prevent the armature from freezing to the permanent

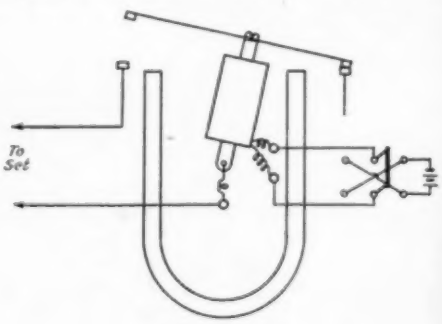


FIGURE 5

magnet poles while still allowing enough attraction to provide good contact. The battery for the electromagnet is wired through a d.p.d.t. switch so that the polarities may be applied as desired. In one position the armature will fly over to one contact and stay there until the reverse polarity is applied when it will click back to the first position again. The battery need only be applied for an instant—long enough to let the armature go to the contact wanted.

A somewhat different mechanical construction for the relay is shown in Figure 5. It will also be noticed that the battery arrangement is not the same. This system operates with a single-pole double-throw switch. The smaller magnetic gap makes this type somewhat more efficient than that shown in Figure 4.

—J. H. Hewson, VE2BX-VE3XM.
—H. P. W.

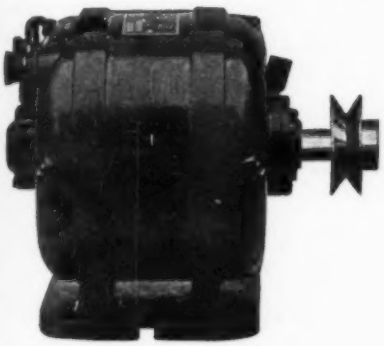
A Multi-Range Voltmeter

(Continued from Page 50)

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1 box 7" by 6.5" by 2.25" of 3/8-inch mahogany	.80

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3	" "	100,000	"	6.00
1	" "	200,000	"	2.50
2	" "	250,000	"	5.00
				$35.50

The fact that this meter require but 1.5 mils for full scale deflection is an important factor; the usual high-voltage meter requires between fifteen and twenty milliamperes for full scale deflection. An additional point that should appeal to the amateur

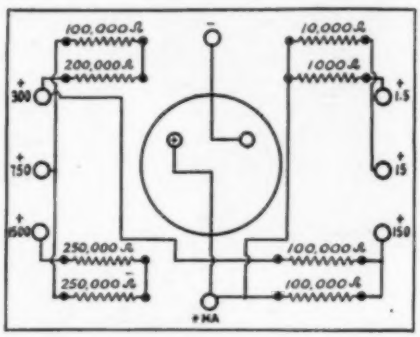


FIGURE 2

who is usually unable to lay any large sum of money at one time is the possibility of buying the parts for such an instrument piecemeal. In this way, it is possible to acquire a worthwhile unit on what is commonly called the "budget plan". Perhaps some salesman will figure out how few cents a day it costs!

A "1929" Receiver

(Continued from Page 32)

any other adjustments to the set, thus protecting the tubes. It also protects the operator against unpleasant "bumps" from

Coil	Secondary	Tickler	Tuning Condenser	Frequency Range in kc. Max.	Min.
No. 1	2 turns	3 turns	5 plates	30,000	27,770
No. 2	8 "	5 "	2 "	14,635	13,955
No. 3	19 "	6 "	2 "	7,370	6,895
No. 4	33 "	7 "	7 "	4,286	3,333
No. 5	8 "	4 "	23 "	14,285	8,820
No. 6	13 "	6 "	13 "	9,835	6,895
No. 7	20 "	7 "	23 "	7,060	4,286

COIL AND CONDENSER COMBINATION

the plus 135 volts on the screen-grid tubes. Another precaution, which may be applied to any receiver, is the insertion of a small flashlight bulb outside the set in the jumper which connects the "A" and "B" negative leads together. If any point on any of the "B" battery circuit comes in contact

The A.R.R.L. Diamond Is the Emblem of a Real Amateur!



The League Emblem comes in four different forms. Its use by Members is endorsed and encouraged by the League. Every Member should be proud to display the insignia of his organization in every possible way.

THE PERSONAL EMBLEM. A handsome creation in extra-heavy rolled gold and black enamel, ½" high, supplied in lapel button or pin-back style. There are still a few fellows who are hiding their light under a bushel. Wear your emblem, OM, and take your proper place in the radio fraternity. Either style emblem, $1.00, postpaid.

THE AUTOMOBILE EMBLEM. Introduced last spring, already more than 800 cars are proudly displaying the mark of the "Radio Rolls-Royce." 5x2½", heavily enameled in gold and black on sheet metal, holes top and bottom, 50c each, postpaid.

THE EMBLEM CUT. A mounted printing electrotype, the same size as the lapel button, for use by Members in any type of printed matter, letterheads, cards, etc. $1.00 each, postpaid.

THE "JUMBO" EMBLEM. You've taken care of yourself, your car and your printing. How about the shack wall or that 100-footer? Think of the attention this big gold-and-black enamel metal emblem will get! 19 x 8¼", same style as Automobile Emblem. $1.25 each, postpaid.

Mail your order and remittance NOW to

The American Radio Relay League : : Hartford, Conn.

NEW RELAYS

for amateurs and experimenters. We would be pleased to hear from you concerning your relay requirements.

If interested in television, write for our price list of television apparatus

Photo Electric Devices, Inc.
594 Fifth Avenue Brooklyn, N. Y.

BECOME A RADIO OPERATOR

See the World. Earn a Good Income.
Duties Light and Fascinating.

LEARN IN THE SECOND PORT U.S.A.

Radio Inspector located here. New Orleans supplies operators for the various Gulf ports. Most logical location in the U.S.A. to come to for training.

Nearly 100% of radio operators graduating on the Gulf during the past six years trained by Mr. Clemmons, Supervisor of Instruction.

All graduates placed to date. Start training now for Spring and Summer runs.

Member of the A.R.R.L.—Call "W5GR"

Day and Night Classes—Enroll anytime—Write for circular.

GULF RADIO SCHOOL
844 Howard Ave. New Orleans, La.

— LAST MINUTE SPECIALS —

R. C. A. Uni-Rectron Power Amplifiers—Model A. P. 935 List $88.50 ea. ...Our Price	$19.75	ea.
E210 BRADLEYSTATS, list $4.00 fine for A. C. Line Voltage Control	1.60	"
Genuine Black Bakelite Panels ⅜" x48", 3/16" thick. Reg. Price $29	8.75	"
U. S. ARMY Aeroplane Spark Transmitters, Gov. cost $47 each	4.75	"
G.E. Kenotron Rectifying Tubes (Type T.B.1.)	1.25	"
Gould Kathanode Unipower, Automatic Radio "A" Power (6 volt), list $39.50	13.75	"
G. E. V.T.14—5 watt Transmitting Tubes (A good power amplifying tube)	1.50	"

AMERICAN SALES CO., 19-21 WARREN ST., NEW YORK CITY

PLATE GLASS FOR TRANSMITTING PANELS

Better insulation and as cheap as rubber panels. All meter holes and screw holes bored to requirements. Frosted on one side and call letters etched on face. Send sketch of panel for estimate and further information.

PEERLESS PRODUCTS CO.
106 No. 9th St. Radio W9FUE, Hiawatha, Kansas.

BEAUTIFUL! AMAZING!!
WONDERFUL!!!

THESE ARE SOME of the enthusiastic comments made by people who know and understand Short Wave Apparatus:



OCTOCOILS

Have become famous overnight. Eight sided Bakeilte molded forms in distinctive colors.

Space wound with Nos. 12-14-16 Bare Copper Wire

3⅝" high 1⅞" diameter.

Rugged — Beautiful — Efficient. Wave length range.

16 meters to 225 meters

List price $4.00 Per set of four coils.

Manufacturers also of the BAIRD SW-Adapter: with special features used by no other manufacturer: Absolutely no AC-Hum interference:

If your dealer cannot supply you order direct: Money refunded without question if unsatisfied.

Mfd. by
SHORTWAVE & TELEVISION LABORATORY INC.
104-106 Brookline Avenue, Dept. K, Boston, Mass.

RADIO OPERATORS !

Are You Handicapped by a weak Amr or other weakness?

95 out of every 100 operators are handicapped by some weakness. Are you one of them? Would you place yourself in the hands of an expert who has developed many of the world's fastest and highest paid operators, and follow his easy instructions if you thought his methods would help you to overcome your weakness? If you knew positively that his system would increase your sending and receiving speed 50 to 100% and make you a TOP-NOTCH operator? Don't delay. Write me in confidence. No obligation. Write NOW!

WALTER H. CANDLER, Originator and Director
THE CANDLER SYSTEM CO.
6343 S. Kedzie Avenue Chicago, Illinois

FREE 1929 WHOLESALE RADIO CATALOG



Dealers—Set-Builders—Write today for this 1929 Wholesale Catalog containing hundreds of money-saving "specials". Over 2,000 items. Complete lines of Radio Sets, Cabinets, Tubes, A & B Eliminators, Speakers, Parts at prices that mean *BIG SAVINGS!*

Complete Television Section
Latest television equipment, A. C. Sets, Short Wave Receivers, Dynamic Speakers also listed. Write Now—Dept. 35

BENSON-ALLEN, Inc., 456 So. State St. CHICAGO, ILL.

64 PAGES OF BARGAINS

SCORES OF MONEY SAVING BARGAINS

with the ungrounded side of the filament circuit, the flashlight lamp will blow for "about twenty cents worth," instead of four nice tubes for "ten or fifteen dollars worth."

In concluding it may be said that, although the receiver has so far been given only a brief test, it promises to live up to the reputation set by Mr. Hull's original model.

The UV-861

(Continued from Page 43)

The direct interlectrode capacities measured according to I.R.E. definition are:

Plate to control-grid (filament and screen together)	0.05	μμfd.
Control grid to filament and screen	17.	μμfd.
Plate and filament to screen	13.	μμfd.

To the man who is desirous of employing all the power the law will allow and

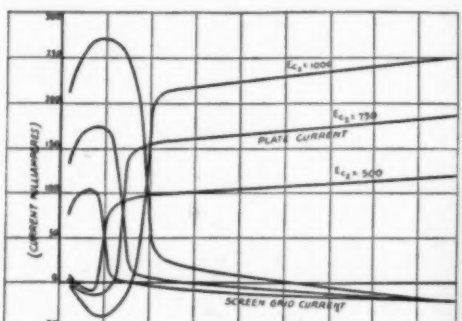


FIG. 5. THIS FAMILY OF CURVES SHOWS THE EFFECT UPON PLATE AND SCREEN CURRENT OF VARIATIONS IN PLATE POTENTIAL.
They show the characteristic dynatron kinks where the plate voltage is lower than the screen voltage.

who is using crystal control or some other form of oscillator-amplifier arrangement, this tube should prove a boon. The main requirement will be for a husky power supply from which to run it!

An Examination of A. C. Plate Supply

(Continued from Page 27)

condition of precise adjustment. The advent of the new mercury vapor rectifier tubes, of course, has introduced an important factor into the case. By avoiding the particular difficulties of adjusting the self-rectified to the standard of performance required at present, the installation of such rectifiers may be the more practical solution to the plate supply problem at all times. In the past, self rectification for the higher voltage tubes was justified by the scarcity and high cost of suitable rectifiers. We sincerely hope that we are correct when we say that this condition no longer exists.

A. R. R. L. Members -- What about your friends?

You must have a friend or two who ought to be members of our A.R.R.L., but aren't. Will you give us their names, so that we may write to them and tell them about the League and bring them in with the rest of us? The A.R.R.L. needs every eligible radio enthusiast within its ranks, and you will be doing your part to help bring this about by recommending some friends to us. Many thanks.

.....1929

American Radio Relay League,
Hartford, Conn

I wish to propose

Mr. .....of .....

Mr. .....of .....
Street & No. Place State

for membership in the A.R.R.L. I believe they would make good members. Please send then a sample copy of *QST*.

.....

.....

TRANSFORMERS
Guaranteed—Mounted—Complete
250 watt 550—700 each side.....$10.50
700 watt 1000—1500 each side..... 14.50
600 watt 2000—2500 each side 18.00
Chokes, Polyphase and 25-cycle Transformers
Add $2.00 for fil. winding
9CES F. GREBEN
1927 So. Peoria Street, Pilsen Sta., Chicago, Ill.

WANTED
50 Watt Tubes
R. C. A. or W. E. Co.
New Used or Burned out
J. T. SCOTT, 908 Western Ave.,
SEATTLE, WASHINGTON



Designed to carry 250 mills **2 HENRY FILTER REACTORS** D. C. Resistance 20 ohms
Fine for use as Generator Filter, also as plate or Grid Reactor ..... **Special $4.75 ea.**
Manufactured by the world's largest electrical concern whose name we cannot mention
List Price $25.00 ea.
AMERICAN SALES CO., 19-21 Warren St., N. Y. CITY

Q S T OSCILLATING CRYSTALS
Amateur Bands

We will grind for you crystals in the various amateur bands. Said crystals to be suitable for power use and frequencies stated accurate to better than a tenth of 1% at the following prices:

1715	to 2000	Kcs	$20.00
3500	to 4000	Kcs	$27.50
7000	to 7300	Kcs	$45.00

Add $10.00 to the above prices if crystal is to be mounted in dustproof power type of holder. Immediate deliveries. All crystals guaranteed regards to frequency and output.

HIGH FREQUENCY AND BROADCAST BANDS

We will grind for you a crystal between 550 and 1500 Kcs to a guaranteed accuracy of plus or minus 500 cycles of your assigned frequency for $45.00 unmounted or $55.00 mounted. Three day delivery and crystals guaranteed.
We will grind a crystal for you to your assigned frequency between 4000 and 6000 Kilo-cycles accurate to plus or minus five hundredths of 1% (.05%) for power use for $75.00 unmounted or $85.00 mounted in power holder. These crystals absolutely guaranteed regards to frequency and output. Five day delivery.

SCIENTIFIC RADIO SERVICE
"The Crystal Specialists" **P. O. Box 86, Dept. B., Mount Rainier, Maryland.**

Complete Parts for
SILVER-MARSHALL
No. 730
"Round-the-World" 4

A COMPLETE short wave receiver (17.4 to 204 meters) and two-stage audio amplifier. All wave lengths are covered with no dead spots. Amateur bands fall well to center of tuning dial. Net $30.00. Completely constructed $38.80. C.O.D. or cash with order. Postage or express extra.

Also Complete Stock of
Leach Relays—R.E.L. Products—3000-Volt Rectobulbs—Omnigraphs—Vibroplexes—Silver-Marshall Shield Grids.

Send for New 1929 Ham Book—FREE

C H I - R A D
CHICAGO RADIO APPARATUS CO.
415 S. DEARBORN ST., CHICAGO

DODGE RADIO SHORTKUT
KILLS HESITATION PRODUCES RESULTS
Has helped raise receiving speed from 15 to 25 in three and half hours—15 to 30 in five hours—10 to 15 in one hour—4 to 12 in four hours etc. etc. Beginners master code and qualify in few days.

REPORTS FROM 500 USERS
telling complete story and who's who with each order. Or with Half Dollar Coupon for 50 cents. Specimen reports on request—sufficient to justify this ad.

DODGE HIGH SPEED METHOD
(Intensive Speed Practice)
Most efficient Code Reading booster known for 25 per Hams. Helped raise speed from 27 to 39 in 75 minutes practice time. Full details in reports.

DODGE MORSE SHORTKUT
Master both codes our way and use without mixup.

Radio Shortkut $3.50 High Speed or Morse $2.50 Money Order. None COD. Foreign add Fifty Cents.

C. K. Dodge, Box 100, Mamaroneck, New York.

PACENT DUO-LATERAL COILS

FOR laboratories, experimenters, engineers and for special circuits, Pacent Duo-Lateral Coils are the accepted standard.



A complete line of all standard turn ratios are always in stock.

Write for information and prices

Pacent Electric Co., Inc.
91 Seventh Avenue, New York

The Design of Inductance Coils

(Continued from page 40)

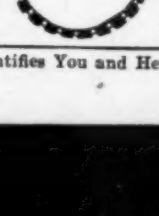
coil Y, the curve B showed a uniform and normal increase extending from 2 to 5 ohms, which is within 2 percent of the resistance for the coil A when free. Between 300 and 450 kc., tuning would have been impossible with the resonant coil inductively or conductively coupled to the tuned circuit. Obviously, shorting the unused coil when it is not required in the circuit minimized such undesirable reactions. As the coil resistance reaches such enormous effective values, useful currents will not only be small, but will also produce a region in the frequency range where it is practically impossible to tune sharply. Well designed receivers have provisions made to overcome these effects, but available data show they do occur in similar radio frequency circuits. Hence, unused portions of the coil, if large, should be shorted, or windings may be divided into sections and provided with the familiar "dead end" switches. Of equal importance, perhaps, is the selection of coil types having a minimum of capacity. Of course there are cases where limited space requires a compactly wound coil of large inductance having inherently large distributed capacity. Such experiments demonstrate simple cases in which coil capacity is effective. To select good coils of minimum capacity is difficult, for many types of winding developed do not provide low distributed capacity although they may afford a very slight reduction of dielectric hysteresis effects due to the peculiar manner in which the wires are wound. We will next consider types of winding and observe by theory and experiment, the characteristics of most well known types.

(This article by Mr. Clemons is in two parts. The second part, which treats various types of windings and their characteristics, will be published in next QST.—Editor.)



A GOOD CHOKE

JACOBS ANTENNA SPREADER



Made in both 5 in. and 7 in. diameter. Patented Sept. 8, 1925; Sept. 7, 1926

Effective Feb. 1st, 1929 price will be $8.00 per dozen; $4.50 for a half dozen

Charles F. Jacobs (W 2EM)
279 Park Place Brooklyn, N. Y.

HAM-ADS

Effective with the October, 1928, issue of *QST* the following changes were made in the rules of this department. The Ham-Ad rate is now 15c per word. The restriction which has limited use of this column to members of the American Radio Relay League is removed and advertising may be signed either by company name or by an individual. A special rate of 7c per word applies to advertising which is obviously non-commercial in nature and which is placed and signed by an individual member of the American Radio League. Please read carefully the following conditions under which advertising in these columns will be accepted.

(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.
(2) No display of any character will be accepted, nor can any special typographical arrangement, such as all or part capital letters be used which would tend to make one advertisement stand out from the others.
(3) The Ham-Ad rate is 15c per word, except as noted in paragraph (6) below.
(4) Remittance in full must accompany copy. No cash or contract discount or agency commission will be allowed.
(5) Closing date for Ham-Ads is the 25th of the second month preceding publication date.
(6) A special rate of 7c per word will apply to advertising which, in our judgment, is obviously non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, used and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the 7c rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and takes the 15c rate. Provisions of paragraphs (1), (2), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

PLATE POWER for your set, the very heart of its performance. For quietness DX ability, life-long permanence, absolute dependability, lowest ultimate cost, no other plate source even approaches the achievement of an Edison steel-alkaline storage B battery. Built painstakingly every joint pure nickel, upset electrically welded. Genuine Edison Electrolyte. Our list describes complete batteries, construction parts, enameled aerial wire, silicon steel. Available immediately, filament and plate transformers for the new 866 rectifier, complete plate power units. Rectifier Engineering Service, radio W8ML, 4937 Rockwood Road, Cleveland, Ohio.

HAWLEY Edison element battery and parts standard for over five years. Look at our patent pending connector—no thin wire to drop off—contains 20 times more metal than regularly used. Heavy shock proof cells, fibre holders, etc. Everything for a rapid-fire "B" supply. Complete assembled 100 volt "B" $10.00. Knockdown kits at still lower prices. Chargers that will charge in series up to 160 volts $2.75 to $4.00. Trickle B Charger for 90 to 150 volt "B" $3.75. Special transmitter "B" batteries up to 6,000 milli-amp capacity, any voltage. Write for interesting literature, testimonials, etc. B. Hawley Smith, 860 Washington Ave., Danbury, Conn.

Used 203 A and 211 $13; new 852 $28; used $20; used Western Electric 212A and 212D $60 each; new Cunningham and RCA 210 $6; new Cunningham and RCA 281 $5; No 12 enameled aerial wire $.90 per 100; Amateur Call Books $.85; 10" insulators $.29; Freshman 375V. and two 7½V. center tapped transformers $2.75; Robbins & Myers motor generator $65; all types used Jewell meters $4.75 each; three tube wired Aero coil set, best equipment $20; REL 50 watt sockets $1.50; signal corps 3/16" contact key $.95; 210 Bradleystats $1.75; new RCA 50 watters $13.50, new 217A, 217B, $23; new 90 volt Philco Storage Btry $8; free list, lots of used and new apparatus. What have you for sale or trade? David L. Marks, 125 Madison Ave., Albany, N. Y.

OMNIGRAPHS, Teleplexes, transmitters, receivers, Vibroplexes, meters, 50 watters, S tubes, motor generators, dynamotors. Bought, sold, traded. Ryan Radio Co., Hannibal, Mo.

THORDARSON 650-volt power-filament transformer for 7½-watters $6.90. Aluminum square-foot 85c; Lead square-foot 85c. UX-210 7½ watters $5.25. UX-250's $7.50. Potter 2000-volt test 1-mfd Condensers $2.50; 2500-volt 1-mfd $3.25; 2000-volt 2-mfd $2.50. "Ham-List" 4c. James Curtis, 1109 Eighth Avenue, Fort Worth, Texas.

GENERAL Electric 24/1500 volt .233 ampere $37.50 Shaft for external drive $3.00 24/750 volt, 2 ampere $27.50. Shafts $3.00. Holtzer-Cabot 12/500 volt 35 watts $20. Crocker-Wheeler 24/1500 volt 450 watts $45. ½KW 500 cycle with exciters $15.00 900 cycle 200 watts with complete transmitter $30. Western Electric Helmets, Westinghouse 6-15 volt 500 watt generators, Special cartridge fuse 1500 volt 300 mills 50c dozen. Literature and fotos. Shipments any quantity anywhere. Henry Kienzle 501 East 84th Street New York.

FOR Sale—complete 50 watt transmitter, meters, panel, power supply, etc., $50.00. W9JG, 3681 Rutger, St. Louis.

FIFTY cents and transportation paid for Murdock molded condensers 483 and 488 in good condition. Write before sending. Dept. of Physics, Univ. of Kansas, Lawrence, Kansas.

POWERFUL, shieldless, loop, antenna circuit $1. Archer, 617 Decatur St., Brooklyn, N. Y.

HAMS look—two complete 7½ watt 80 meter transmitters complete with Aero coils, three Jewell meters and Cardwell condensers.—Two complete short wave receivers complete with Aero coils and Karas condensers.—Write for price and description. Harger & Blish Inc. 112 11th. Street, Des Moines, Iowa.

ENSALL Radio Laboratory receivers and Transmitters are of the most modern designs and are supplied to meet any particular requirements of the radio art. Transmitter designs for radiophone or C. W. Our long experience in the designing of special apparatus is your guarantee of quality and efficient apparatus. We also build to order any items desired. Literature on any apparatus forwarded on request. Ensall Radio Laboratory 1208 Grandview Ave., Warren, Ohio.

1929 Coils like August *QST* page 18 for 25 cents per turn. Antenna coils 20 cents per turn. W2VQ 388 North Grove St., East Orange, N. J.

CRYSTALS—First time offered to Hams. Easiest oscillators. Ground on Optical Laboratory Machinery with lens grinding precision. Unexcelled workmanship. 170 Band $15.00 85 Band, $18.00. Dr. Elmer J. White Optical Laboratory, W5AFG. Beaumont, Texas.

SELL QSTs from May 1922 to December 1923 inclusive. W3BSF.

QSL cards, 40c per 100, samples. Radcliffe, North Sacramento, Calif.

W8MG owned by E. F. Goodwin deceased selling out, great variety of equipment. 1 Kw. tube, ¾ Kw., ¼ Kw. tubes, several fifties and MG sets. Also several receiving sets, etc. Write for lists. L. M. Augustus, 416 Florence St., Ypsilanti, Mich.

HAMS: Get our samples and prices on printed call cards made to order as you want them. W9APY Hinds, 19 S. Wells St., Chicago, Ill.

IN stock, Rectobulbs $15, TB1 Kenotrons 95c, 82-85.6 meter Xtals $17.50, 99.6% aluminum 70c sq. ft., no. 12 enameled wire 1c a ft., 25% off on Thordarson, Jewell, Leach, Signal, Sangamo, REL, Ward Leonard, 35% on Tobe and Flechtheim. The new Rectobulb $10.00. Tubes repaired, Write for prices, Henry's Radio Shop, 9ARA, Butler, Mo.

SPECIAL made rectifier aluminum with small percentage copper, stand more amperage, last longer, square foot $1.25. Lead $1.00. Elements, holes punched with bolts and nuts, new kind 1"x4" 15c, 1"x6" 17c, pair prepaid. Best Silicon steel .014" cut to order 25-35c lb. Postage extra. Geo. Schulz, Calumet, Mich.

CHOKES—Dudlo-wound 50H. 150MA., unmounted—$2 25. 30H. 100MA—$1.50. 'B'Eliminator transformers 215V-7½V—$1.75. Aerovox 5000 ohm Wire-wound gridleaks —50c. Pure rectifier elements and copper tubing inductance. Send for "Specials". Quick service. William Harrison, 35 Ft. Washington Ave. New York City.

SELLING out—write for list. W. E. Van Valkenburg, 1005 S. 17th St., Fort Dodge, Iowa.

USED parts bought, sold, exchanged. List. W9CKA, Corwith, Iowa.

QUARTZ crystals, guaranteed oscillators, 83 to 85 $20.00; 165 to 170 $15.00. Includes holder, easy to mount brass discs with lapped surfaces. Prepaid, cash with order. D. C. Akers, 181 Greenwood Ave., East Orange, N. J.

TRANSFORMERS with high voltage and two 7½ filament windings all center tapped—unmounted 200 watt size 1500 volts at $7.50. Unmounted 100 watt size 1100 volts at $6.00. 50 Henry 100 mill chokes at $3.25. General Electric grid leaks in stock. W2CO, 210 Springdale Ave., East Orange, N. J.

3000 Volt 6000 Watt double commutator motor generator, 10 Hp. 3-phase drive $685.00 complete. 2000 Volt 1000 Watt 1-phase drive $225.00. 1500 Volt, 500 Watt 3-phase drive $125.00. 1000 Volt 200 Watt Esco 1-phase drive $75.00. 100 Volt 300 Watt, 1-phase drive $75.00. 750 Volt 300 Watt $65.00. 200 Watt $45.00. 350 Volt, 50 Watt motor generators, $18.50. 400 Volt 100 Watt generators $8.50. Couplings $1.75. Television Motors with controller $7.00. Large stock filament generators. Queen City Electric Co., 1734 Grand Avenue, Chicago, Illinois.

3000 Volt 4000 Watt double commutator motor generator. Generator direct connected to 110-220 Volt, 60 cycle, 1-phase motor. Fields separately excited by another motor generator 1-phase drive. Complete ready for installation, $550.00. James Smat, 1734 Grand Avenue, Chicago, Illinois.

QSL cards. Cartoons, Anything hams want. H. M. Selden, Cranesville, Pa.

BARGAIN flyer—power relay for use in your transmitter. Has tungsten steel contacts and will easily break 2000 volts. Can be kicked over by dry cell or storage battery. Eliminates danger of high voltage thru key and fb for remote control. A real buy. Order now at $2.00 each, prepaid. Cash, check or money order. Mitchell Radio Co., 635 Waveland Ave., Chicago, Ill.

QSL cards, two colors, $1.00 per hundred. Free samples. W8DTY, 257 Parker Ave., Buffalo, N. Y.

TRANSFORMERS, plate and filament supply transformers for 25-40-50-60 and 500 cycle supply, built to your order. High grade work, moderately priced. Nat G. Scott, New Albany, Miss.

MILLIAMMETERS, flush panel mounting, hand calibrated and accurate. Your choice 0-100, 0-300, or 0-400, $1.25 Postpaid. Twenty-four hour service. New Price List mailed on request. G. F. Hall, 535 West Hortter St., Philadelphia, Pa.

FIVE disc Omnigraph with 12 discs. Best offer by February 15 gets it. Eber C. Byam, R1, B 112, Rosewell, N. M.

SELL—Grebe CR9 and CR12 perfect condition; make offer. W5DD, Clarksville, Ark.

OMNIGRAPH, 15 dial in cabinet. Buzzer ,transformer, Western Electric phone, $17.50. Two S tubes $4.50 each. 600-0-600 transformer $7.50. Filament transformer mounted, three 8 volt insulated windings $5.00. 15 volt 35 ampere, unmounted $4.50. Four tube receiver, one shield grid. New, very neat convenient designed. 15-200 meters in short steps, coils up to 800. $50.00 with set new selected Cunningham tubes. 1929 Hartley transmitter, page 9 August *QST*. New, without meters, $22.00. Hal Justice, W4TS, Canton, North Carolina.

SHORTWAVE receiver (2) two tube 15 to 210 meter, $16.50 each; U. S. Army 5 watter, $1.50 each; Perryman UX216B $2.00. H. MacLeod, Seaford, N. Y.

MOTOR generator bargains. 750 Volt, 200 Watt, two commutator new General Electric motor generators direct connected to 110 Volt, 60 Cycle, 3500 R.P.M. single phase A.C. motors each $45.00. 350 Volt, 150 Watt new General Electric motor generators direct connected to 110 Volt, 60 Cycle, 3500 R.P.M. single phase A.C. motors, with field resistance, each $27.50. New ¼ HP. General Electric and Westinghouse 110 Volt, 1750 R.P.M., A.C. motors $8.75 each. New television variable speed motors for 110 Volt Alternating Current $7.00 each. A limited number of each of the above items. Also many others to 3000 volts all sizes. Write us your needs. Electrical Surplus Company, 1911 Chicago Ave., Chicago, Ill.

QSLs, 100 two color $1.00. Government $1.90, radiograms, stationery. Samples. W9CKA, Corwith Iowa.

NEW Morton Electric Company motor generator sets, 750V 250W, $45.00. 1500V 500W 6 bearing wickoiled unit, $110. 110V 60 cycle motor drive. A Forbes, 4832 Rice St., Chicago, Ill.

275 volt generators, $8. 600 volt $18. 6 to 400 volt dynamotors $15. 30 to 300 $8. 500 cycle ½kw $15. 200 watt $10. R. Wood, 46-20 102nd St., Corona, N. Y.

WANTED: Navy standard receivers SE143, SE1220, SE1420, IP500, IP501. State manufacturer, condition and price. Trautwein, 17 Albany St., New York.

SPEAKERS, Rewound, Magnetized, Guaranteed, Fast Service, $1.50 to $2.50. Clark Brothers Radio Co., Albia, Iowa.

B ELIMINATORS, Repaired, New Condensers, Transformers, Chokes, Etc., Fast Service, $2.00 to $4.00. Clark Brothers Radio Co., Albia, Iowa.

TRANSFORMERS 250 watt 2000V unmounted $8.00. 650V 7½-7½ $5.50. 550V-5 $4.00. Chokes 250 M.A. 30H $7.50. 160 M.A. 30H $5.00 100 M.A. 30H $2.00. Write for specifications and material lists. Radio Parts Sales Co., Orange, N. J.

ELECTRIC Specialty Company motor generator, motor type BLR-22, 110-220 volts, 60 cycles, 1700 RPM, 1 HP, Generator type L-28, volts 1000 amp. .5, compound wound, run about five hours. Cost $175.—sell for $100. J. L. Walsh, Missouri-Kansas-Texas RR Co., Dallas, Texas.

LITTELFUSES: the quickest-acting fuses in the world. See for yourself. Designed for protection of instruments, tubes and delicate equipment generally. Capacities: 1/32, 1/16, ⅛, ¼, ½, 1, 2 amperes. 1" long x ¼" dia. Each —15c; doz.—$1.50; 100—$10.00. Postpaid. Mounting blocks—20c. Discount to dealers. Littelfuse Labs., 1172 Wilson Ave., Chicago.

LARGE stock BC and SW sets and equipment don't need. Sell or trade for transmitting parts. C. C. Grayson, Box 825, Mexia, Tex.

SELL: 1KVA transformers 1100-2200-4400V each side CT, 110-220 primary. Used by Cornell Uni. at $12.00. F.O.B. Det. F. G. Dawson, 5740 Woodrow Ave., Detroit, Mich.

IMAGINE an organization with over 4,000 clients scattered throughout the world, all radiowise dealers, builders, experimenters, hams. Over $50,000.00 stock of high grade receiving and transmitting parts only no sets. Spend $5,000.00 yearly on our own experimenting. Carry nothing until it passes our tests. 50c brings prepaid over four pounds catalog, circuits, data, etc. Weekly data (more than all radio magazines together) —20 weeks—$1.00, 52 weeks—$2.50. Sample "Over The Soldering Iron," 32 page experimenter's magazine—25c. Full trade discounts to licensed hams and radiowise builders. We carry approved items advertised in radio. Kladag Radio Laboratories, Established 1920, Kent, Ohio.

SELL—Hundred watt panel transmitter (three Cardwells, three Westons); plate and filament transformers; rotary converter for 110 d.c.; series resistance for 240 d.c. Lieut. Wenstrom, West Point, N. Y.

FOR sale: Emerson 500 volt 110 a.c. motor generator and field regulator like new, $36.00. F. W. Steffen, Hartley, Iowa.

FOR sale: I new DeForest H. R. 1000 volt rectifier tube, $10.00. Frank Dixon, Knoxville, Iowa.

WANTED—Good used 204A tube, also one S-tube. State price. Harry Legler, Hiawatha, Kansas.

WANTED: Grebe CR-18 A1 condition. Karl Black, 12 Brewster St., Rockland, Maine.

DUBILIER .004 transmitting condensers wanted. Radio, 150 West 22nd St., New York.

WANTED: One Burned Out General Electric RCA 750 watt Shield Grid Tube. C. F. Wm. Bates, 9410 St. Catherine Ave., Cleveland, Ohio.

CRYSTALS: Carefully selected for maximum output. Your complete satisfaction guaranteed, 85 meter band, $17.50. Blanks $4.00. W9DRD, Hollister, Edwardsville, Kansas.

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18 Boylston Street, Boston

Send for Catalogue

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W1BUD A. L. Budlong "bud."
W1CEI-W1SZ J. J. Lamb "jm."
W1ES A. A. Hebert "ah."
W1KP F. C. Beekley "beek."
W1PX C. G. Kenefick "ck."
W1SZ-W1BIZ C. C. Rodimon "rod."
L. R. Huber "ou."
R. A. Hull "rah."

W1CTR—Daniel J. Giro, 56 Lafayette St., Portland, Maine.

W2CY—W.Thurston Weatherbee, Sunrise Trail, East Moriches, Long Island, N. Y.

W5VV—Wilmer Allison, 1502 West Ave., Austin, Texas.

W7WD—F. A. Wright, P. O. Box 611, Omak, Wash.

W8FC—W. Knight Hamilton, 26 Bay St., Potsdam, N. Y.

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of all descriptions made to your specifications.

The crying need of the radio constructor and amateur for *efficient* coils, chokes, and transformers for either transmitter or receiver construction, is filled by the *"Most Efficient"* Power equipment manufactured by I. R. NELSON CO.

The new and radical core design developed by this company gives the small power transformers and coils all the efficiency inherent in large electrical construction work. Write in your wants. We will be glad to quote you. You will be surprised at the quality received for your investment. Prompt delivery on all orders.

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Bond Street Newark, N. J.

Never before at this Sacrifice Price!

Radiotron Model UV-204.
250 Watt Transmitting Tubes



Normal Plate Voltage 2000 V. Filament Voltage 11 V.

The operating characteristics of this 250 watt tube is similar to that of the UV-204-A. Radiotron with the exception that the filament current is higher. Aside from this modification the tube is interchangeable.

At our price you should carry a few of these tubes if only as spares.

These genuine R.C.A. UV-204 Transmitting Tubes are first grade, brand new, and packed in original factory crates.

Terms:—20% with order, balance C. O. D.

***Extra Special* $52.00 ea.**

Net Price **$127.50 ea.**

AMERICAN SALES CO., 19-21 Warren St., NEW YORK

HOW MANY TIMES

This year will you miss schedules while you turn scrubwoman, or wait on a burned out kenotron? How many volts are you losing in that maze of jars? Hundreds. No need for it. The mercury arc is on the job every minute of the year—you don't have to baby it, leave that to the YLs. No filament to burn out, full wave. Regulation? Just a 15 volt drop, and what's that in a couple thousand? Get an arc and operate.

RECTIFIER ENGINEERING SERVICE, 4837 Rockwood Road, W8ML, Cleveland, Ohio

To Our Readers who are not A.R.R.L. members

Wouldn't you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on page 6 of every issue. We should like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio. You will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below—clip it out and mail it today.

A bona fide interest in radio is the only essential qualification for membership.

American Radio Relay League,
Hartford, Conn., U. S. A.

I hereby apply for membership in the American Radio Relay League, and enclose $2.50 ($3 in foreign countries) in payment of one year's dues. This entitles me to receive *QST* for the same period. Please begin my subscription with the ..... issue. Mail my Certificate of Membership and send *QST* to the following name and address.

.....

.....

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may send him a sample copy of *QST*?

.....

Thanks

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EDITORIALS

ELSEWHERE in this issue there is described in considerable detail the revision of the plan of affiliation between the Signal Corps of the Army and the amateurs of the United States which has resulted in what is known as the Army-Amateur Radio System. This is an announcement of great importance, describing a plan which we feel is destined to play a big part in the future life of the American amateur. We earnestly urge that every amateur thoroughly familiarize himself with it.

The plan is a double-barreled one, with many advantages to both parties. Aside from the rendering of public service in time of emergency, the chief function of the plan, it will provide us amateurs with a most interesting field of work, while from the Army standpoint a large number of amateurs will be made familiar with Signal Corps work and learn to like it, so that the plan has value as an element in preparedness. The existence of the plan assures the amateur of the powerful backing of the Army—one of the purposes is cited as the rendering of "such encouragement and assistance as may be desirable to firmly establish and perpetuate the American amateur". The Army training provided by the plan must be regarded, however, as altogether incidental to its main objective, which is to provide a system of communication that will be of public service in times of emergency when land-line communication has been seriously damaged or destroyed. This is the field of service in which the amateur is at his best—where he is a really invaluable public asset, as he has demonstrated times without number in the past. It is altogether fitting and proper that our emergency communications service should be tied in with the Army, inasmuch as it is a part of the plan of government in our country that it is the Army which steps into any situation which has got beyond civil control and which has the duty of assuming charge and bringing about relief, whatever the needs may be. The plan really answers a need which we have felt for some directed control of our amateur emergency work in order that it may be of the greatest effectiveness.

The building up of this system to a point of efficiency is to be secured by weekly practice in a traffic scheme which is detailed in the published plan. This traffic scheme offers good fun for the active amateur and, in fact, it seems to us provides a perfectly fascinating new field of operating activity, an idea which is new to the amateur ranks and which indeed in time may well revolutionize our methods. It employs the principle of controlled nets, old in military communication but new to the amateur world. The idea is a complex one and there is no blinking the fact that it introduces numerous difficulties which may make progress somewhat slow, but this only adds to the fascination of the scheme. The net idea in communications has been well tried and proved as effective in any communications plan in which orderly operation must be introduced into the activity of a large number of stations. That, of course, is the chronic need in organized amateur communication. There may be some technical difficulties, too, inasmuch as many of the stations in the plan must be prepared to shift frequency quickly and exactly, and it may be that we shall have to call upon our technical development program to produce for us a transmitter of greater flexibility in adjustment than we have been accustomed to in the past. But even this idea is enticing, and adds to the zest which we expect to find in the operation of the new Signal Corps plan.

There is a place in this plan for *every* amateur. Some of the positions will be highly important, offering a real test of the skill of an advanced amateur. A very large percentage of the stations will be operating in two nets and thus will have the opportunity not only of serving as a member of a higher net but of taking their turn as the controlling station for a lower net of subordinate stations. And it takes but one night a week of a fellow's time. There is, we say, a place for everybody, and everybody is needed in order to make the plan of maximum success and to bring to amateur radio the great potential benefits that reside in it. We therefore urge your participation to the fullest, and request all interested amateurs to communicate with their Corps Area Signal Officer, a directory of whom will be found in the Communications Department Section of this issue.

AS HAPPENS every year at this season, the Federal Radio Commission and the Radio Division of the Department of Commerce have been receiving a large number of complaints from broad-

BEAUTIFUL! AMAZING!!
WONDERFUL!!!

THESE ARE SOME of the enthusiastic comments made by people who know and understand Short Wave Apparatus:



OCTOCOILS

Have become famous overnight. Eight sided Bakeilte molded forms in distinctive colors.

Space wound with Nos. 12-14-16 Bare Copper Wire

3⅝" high 1¾" diameter.

Rugged — Beautiful — Efficient. Wave length range.

16 meters to 225 meters

List price $4.00 Per set of four coils.

Manufacturers also of the BAIRD SW-Adapter: with special features used by no other manufacturer: Absolutely no AC-Hum interference:

If your dealer cannot supply you order direct: Money refunded without question if unsatisfied.

Mfd. by
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RADIO OPERATORS !

Are You Handicapped by a weak Amr or other weakness?

95 out of every 100 operators are handicapped by some weakness. Are you one of them? Would you place yourself in the hands of an expert who has developed many of the world's fastest and highest paid operators, and follow his easy instructions if you thought his methods would help you to overcome your weakness? If you knew positively that his system would increase your sending and receiving speed 50 to 100% and make you a TOP-NOTCH operator? Don't delay. Write me in confidence. No obligation. Write NOW!

WALTER H. CANDLER, Originator and Director
THE CANDLER SYSTEM CO.
6343 S. Kedzie Avenue Chicago, Illinois



with the ungrounded side of the filament circuit, the flashlight lamp will blow for "about twenty cents worth," instead of four nice tubes for "ten or fifteen dollars worth."

In concluding it may be said that, although the receiver has so far been given only a brief test, it promises to live up to the reputation set by Mr. Hull's original model.

The UV-861

(Continued from Page 43)

The direct interlectrode capacities measured according to I.R.E. definition are:

Plate to control-grid (filament and screen together)	0.05	μμfd.
Control grid to filament and screen	17.	μμfd.
Plate and filament to screen	13.	μμfd.

To the man who is desirous of employing all the power the law will allow and who is using crystal control or some other form of oscillator-amplifier arrangement, this tube should prove a boon. The main requirement will be for a husky power supply from which to run it!

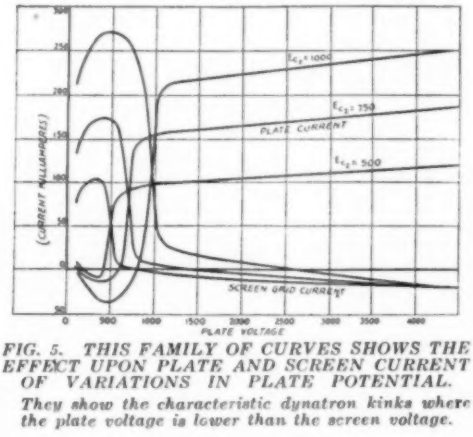


FIG. 5. THIS FAMILY OF CURVES SHOWS THE EFFECT UPON PLATE AND SCREEN CURRENT OF VARIATIONS IN PLATE POTENTIAL.
They show the characteristic dynatron kinks where the plate voltage is lower than the screen voltage.

An Examination of A. C. Plate Supply

(Continued from Page 27)

condition of precise adjustment. The advent of the new mercury vapor rectifier tubes, of course, has introduced an important factor into the case. By avoiding the particular difficulties of adjusting the self-rectified to the standard of performance required at present, the installation of such rectifiers may be the more practical solution to the plate supply problem at all times. In the past, self rectification for the higher voltage tubes was justified by the scarcity and high cost of suitable rectifiers. We sincerely hope that we are correct when we say that this condition no longer exists.

A. R. R. L. Members -- What about your friends?

You must have a friend or two who ought to be members of our A.R.R.L., but aren't. Will you give us their names, so that we may write to them and tell them about the League and bring them in with the rest of us? The A.R.R.L. needs every eligible radio enthusiast within its ranks, and you will be doing your part to help bring this about by recommending some friends to us. Many thanks.

.....1929

American Radio Relay League,
Hartford, Conn

I wish to propose

Mr. .....of .....

Mr. .....of .....
Street & No. Place State

for membership in the A.R.R.L. I believe they would make good members. Please send then a sample copy of *QST*.

.....

.....

TRANSFORMERS

Guaranteed—Mounted—Complete

250 watt 550—700 each side.....$10.50
700 watt 1000—1500 each side..... 14.50
600 watt 2000—2500 each side 18.00
Chokes, Polyphase and 25-cycle Transformers
Add $2.00 for fil. winding
9CES F. GREBEN
1927 So. Peoria Street, Pilsen Sta., Chicago, Ill.

WANTED
50 Watt Tubes
R. C. A. or W. E. Co.
New Used or Burned out
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Designed to carry 250 mills **2 HENRY FILTER REACTORS** D. C. Resistance 20 ohms

Fine for use as Generator Filter, also as plate or Grid Reactor ..... **Special $4.75 ea.**

Manufactured by the world's largest electrical concern whose name we cannot mention

List Price $25.00 ea.

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Amateur Bands

We will grind for you crystals in the various amateur bands. Said crystals to be suitable for power use and frequencies stated accurate to better than a tenth of 1% at the following prices:

1715	to	2000 Kcs	$20.00
3500	to	4000 Kcs	$27.50
7000	to	7300 Kcs	$45.00

Add $10.00 to the above prices if crystal is to be mounted in dustproof power type of holder. Immediate deliveries. All crystals guaranteed regards to frequency and output.

HIGH FREQUENCY AND BROADCAST BANDS

We will grind for you a crystal between 550 and 1500 Kcs to a guaranteed accuracy of plus or minus 500 cycles of your assigned frequency for $45.00 unmounted or $55.00 mounted. Three day delivery and crystals guaranteed.
We will grind a crystal for you to your assigned frequency between 4000 and 6000 Kilo-cycles accurate to plus or minus five hundredths of 1% (.05%) for power use for $75.00 unmounted or $85.00 mounted in power holder. These crystals absolutely guaranteed regards to frequency and output. Five day delivery.

SCIENTIFIC RADIO SERVICE

"The Crystal Specialists" **P. O. Box 86, Dept. B., Mount Rainier, Maryland.**

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No. 730

"Round-the-World" 4

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Also Complete Stock of

Leach Relays—R.E.L. Products—3000-Volt Rectobulbs—Omnigraphs—Vibroplexes—Silver-Marshall Shield Grids.

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KILLS HESITATION PRODUCES RESULTS

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telling complete story and who's who with each order. Or with Half Dollar Coupon for 50 cents. Specimen reports on request—sufficient to justify this ad.

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Most efficient Code Reading booster known for 25 per Hams. Helped raise speed from 27 to 39 in 75 minutes practice time. Full details in reports.

DODGE MORSE SHORTKUT

Master both codes our way and use without mixup.

Radio Shortkut $3.50 High Speed or Morse $2.50 Money Order. None COD. Foreign add Fifty Cents.

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FOR laboratories, experimenters, engineers and for special circuits, Pacent Duo-Lateral Coils are the accepted standard.



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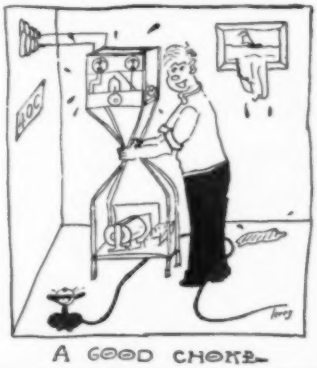
91 Seventh Avenue, New York

The Design of Inductance Coils

(Continued from page 40)

coil Y, the curve B showed a uniform and normal increase extending from 2 to 5 ohms, which is within 2 percent of the resistance for the coil A when free. Between 300 and 450 kc., tuning would have been impossible with the resonant coil inductively or conductively coupled to the tuned circuit. Obviously, shorting the unused coil when it is not required in the circuit minimized such undesirable reactions. As the coil resistance reaches such enormous effective values, useful currents will not only be small, but will also produce a region in the frequency range where it is practically impossible to tune sharply. Well designed receivers have provisions made to overcome these effects, but available data show they do occur in similar radio frequency circuits. Hence, unused portions of the coil, if large, should be shorted, or windings may be divided into sections and provided with the familiar "dead end" switches. Of equal importance, perhaps, is the selection of coil types having a minimum of capacity. Of course there are cases where limited space requires a compactly wound coil of large inductance having inherently large distributed capacity. Such experiments demonstrate simple cases in which coil capacity is effective. To select good coils of minimum capacity is difficult, for many types of winding developed do not provide low distributed capacity although they may afford a very slight reduction of dielectric hysteresis effects due to the peculiar manner in which the wires are wound. We will next consider types of winding and observe by theory and experiment, the characteristics of most well known types.

(This article by Mr. Clemons is in two parts. The second part, which treats various types of windings and their characteristics, will be published in next QST.—Editor.)



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JACOBS ANTENNA SPREADER



Made in both 5 in. and 7 in. diameter. Patented Sept. 8, 1925; Sept. 7, 1926

Effective Feb. 1st, 1929 price will be $8.00 per dozen; $4.50 for a half dozen

Charles F. Jacobs (W 2EM)

279 Park Place Brooklyn, N. Y.